The Electrical Industry's Weekly Magazine

November 5, 1956

Electrical World

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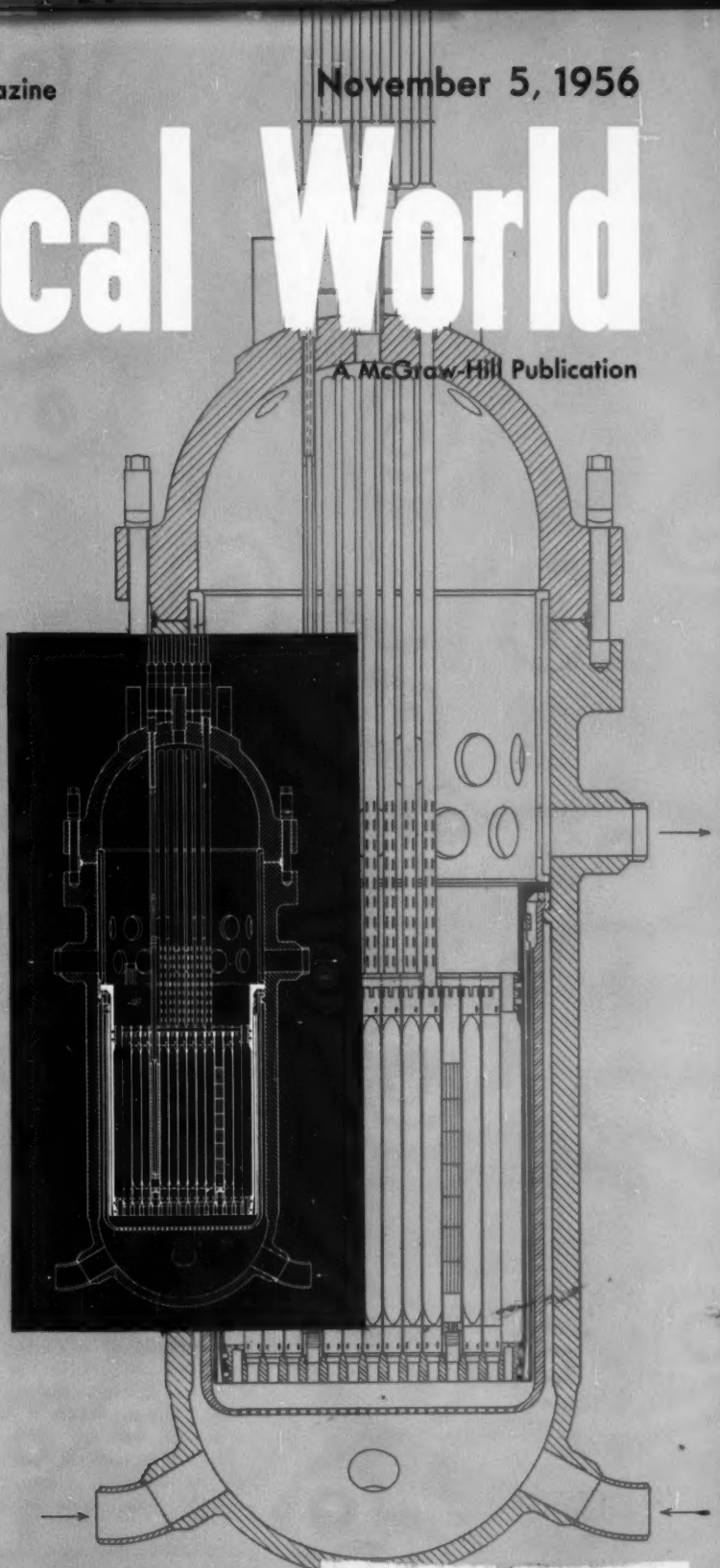

PWR A-Plant Maintenance Is Safer, Quicker, Cheaper than You Think

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Beyond the Election: What Power Policies? . . . page 8

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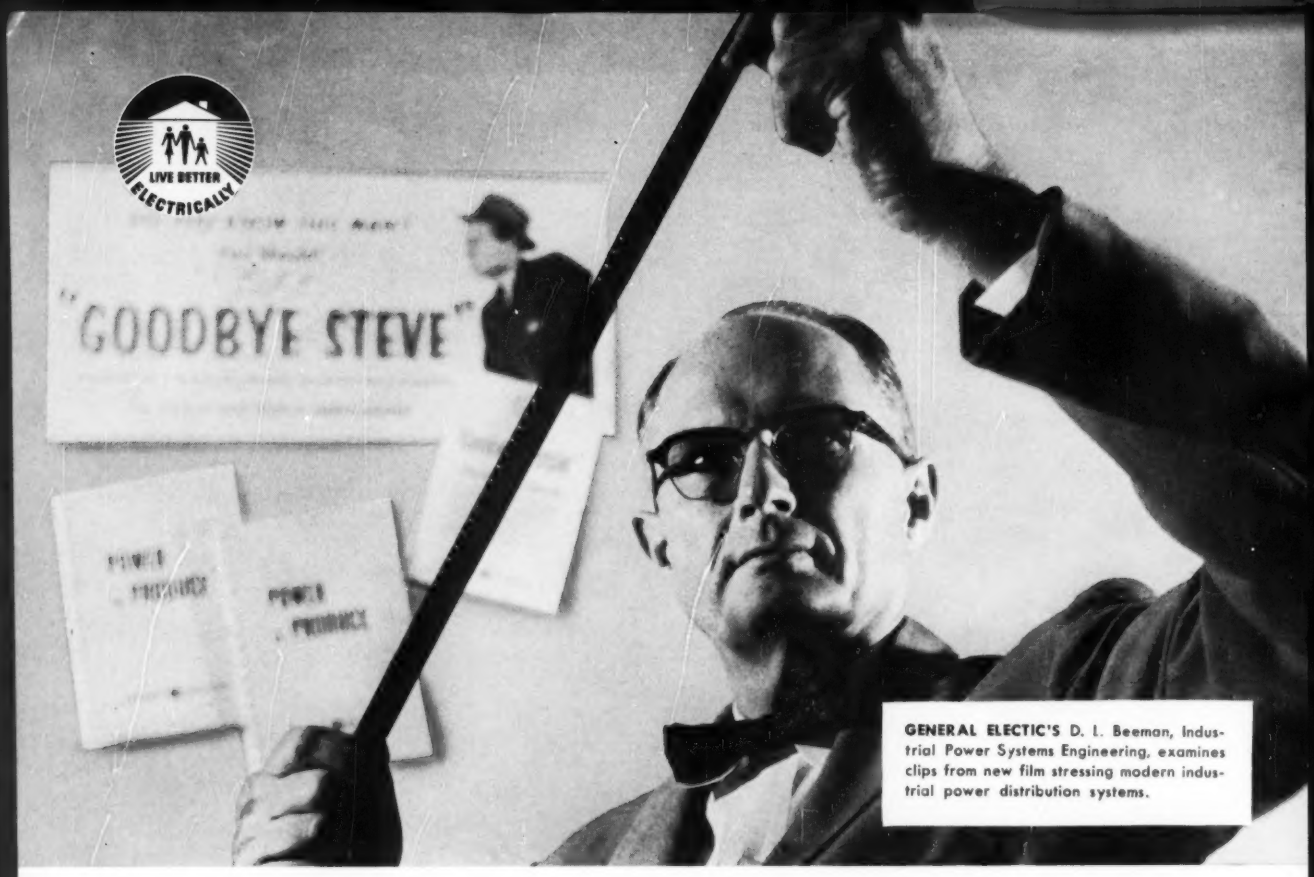
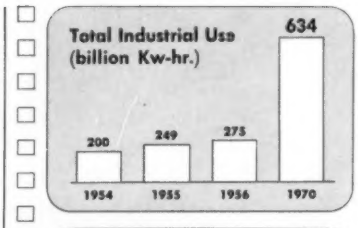
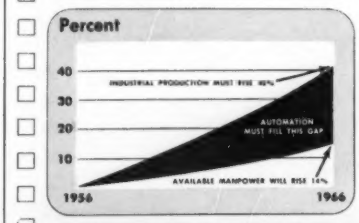


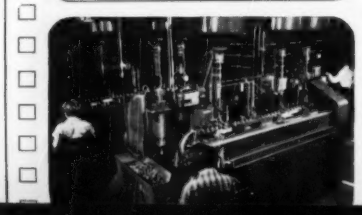
GENERAL ELECTIC'S D. L. Beeman, Industrial Power Systems Engineering, examines clips from new film stressing modern industrial power distribution systems.

New Industrial Power Distribution Program helps pave way for automation by spurring plant expansion and modernization to . . .

Remove bottlenecks to realization of industrial load growth forecasts







General Electric's Industrial Power Distribution Program is designed to focus attention on industrial plant power distribution systems, too often neglected by industry. By so doing, it will help pave the way towards meeting load growth forecasts, and will accelerate the trend to automation.

Economists predict that by 1966, the demand for goods and service will increase over 40%, while the available work force will increase only 14%. Obviously the gap will have to be filled by automated processes.

In order to make automation workable, the user must prepare for greater load and closer regulation through a more efficient power distribution system. To help effect this, General Electric has recently launched a comprehensive "More Power to America" program stressing reliability, economy, safety, flexibility and expandability in the plant's distribution system.

A color motion picture, "Goodbye Steve," the manual "Power to Produce," advertisements, Productivity Forums and a host of other aids will explain to industry the need for streamlining its power distribution systems. Motion pictures and manuals to help pave the way to automation for your industrial customers may be obtained through your General Electric Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 301-322

FORECASTS SHOW industry's use of power climbing to 634 billion kw-hr by 1970*. Automation will eventually fill the void left by an insufficient labor force. Automated processes (bottom) like this, used for condenser parts assembly, typify future production lines. *Source: McGraw-Hill Publishing Co.

MORE POWER TO AMERICA

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or supplying electric power

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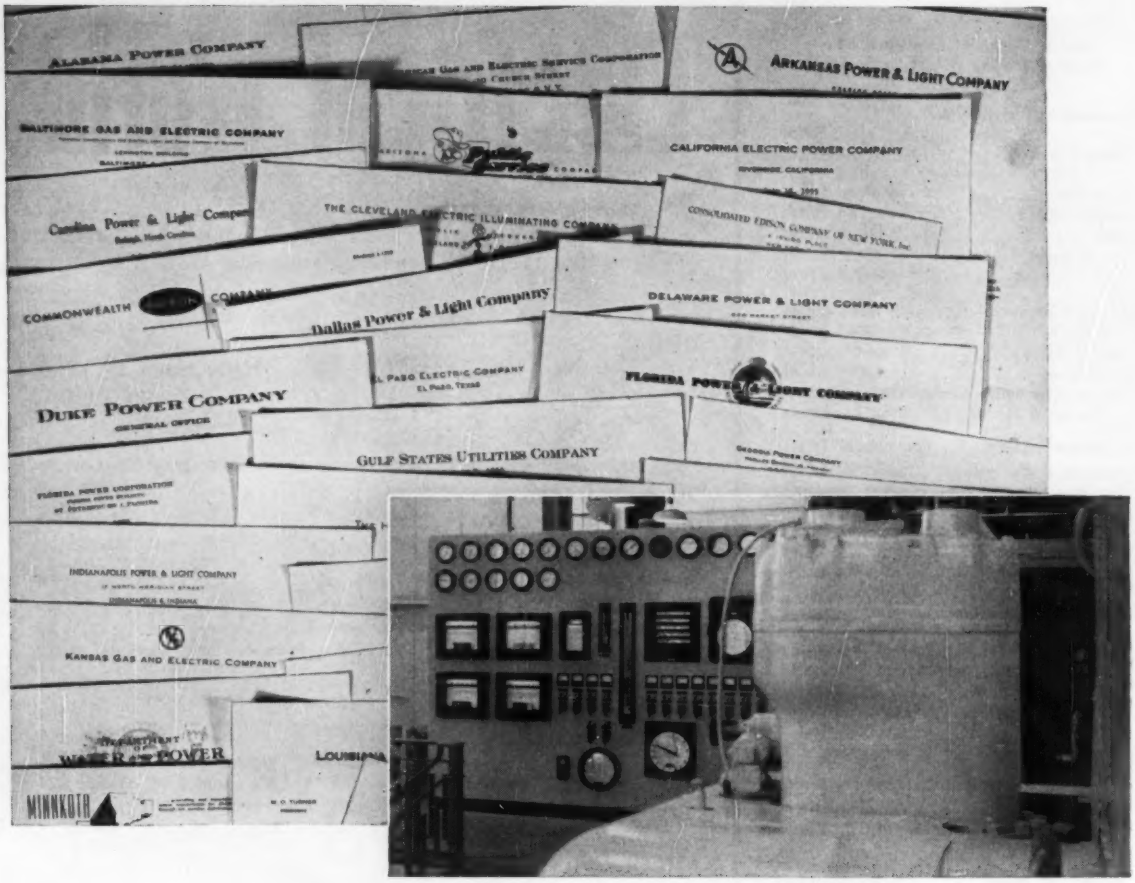
COMING NEXT WEEK—For those operating today's power systems one of the great problems is service reliability. In a 16-page report will be some of the answers to "What Puts Quality in Your Service?"



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EDITORIALS

Quick Recovery – A Waning Controversy

Today's controversy over controlled off-peak vs quick recovery water heating might just as well be forgotten. From the looks of things it's going to fade out anyway as summer peaks increase and other high-wattage appliances gain acceptance in the home. Authorities recognize that the peak contribution of quick recovery is being diluted, that its increasing popularity is grounded in customer acceptance, and that it coincides with the trend to simpler, more promotable rates.

A clue to what's happening is in Electrical World's summer peak survey (Sept. 17, p 124). In spite of cooler-than-normal peak weather, utility summer peak loads moved up nearly 10%. What's more, 14 of the 90 companies surveyed reported an annual peak in summer; and there'll be more next year. A recent Middle West Service Co study predicts that by 1965 utilities serving 78% of all customers will have their annual peak in summer.

These mounting summer air-conditioning peaks reflect a fast-changing pattern of residential demand that is forcing re-evaluation of utility sales policies and the streamlining of rate structures. Recent months have seen a rash of rate adjustments by companies who want more promotable prices for service. Much of this is in the "heat storm" belt.

One vice president of a "heat storm" company put it this way: "With our new rates we're out to promote every possible residential application that isn't likely to peak at 3 PM on a hot summer day. To our mind this includes space heating, lighting, the clothes dryer, and the quick recovery water heater."

Quick recovery's load will be a secondary concern tomorrow when the connected load of a residence is up around 30 kw and higher. Rate expert C. S. Reed, Duke Power Co vice-president, says this: "Water heating is not going to be so important to demand in the future, what with new devices coming into the home like high wattage dryers, house heating, and central air conditioning."

Finally, quick recovery water heating is gaining in customer popularity. Electric heater sales are up 10% over 1955 where quick recovery units are sold and 10% behind in low-wattage off-peak areas, one manufacturer reports. One West Coast company reports that since taking on high wattage units, annual water heater sales jumped 400% in its urban areas—112% in rural.

It all boils down to this: The customer likes rapid recovery performance in a water heater. We must make up our mind now if we want to promote water heating through this quick-recovery approach. It would be a shame to lose this additional load opportunity while arguing a point that time already is resolving.

Let Congress Learn the Will of the People

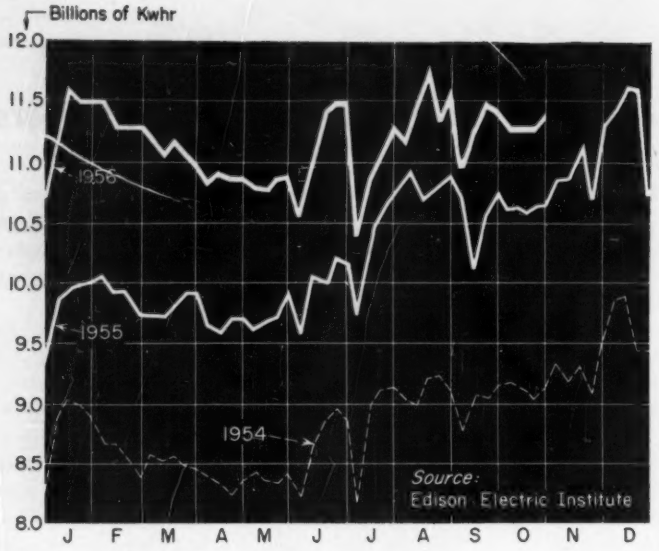
One of the soundest criticisms of our Congressmen is that their actions do not reflect the will of the people whom they represent. But what is the will of the people? One Congressman, Rep Frank C. Osmers, Jr, (R-N.J.) makes an honest effort to find out. At intervals he sends a questionnaire to a sample list of the voters in his district. He gets their opinion on questions of the day and then reports his findings.

The results show that on some subjects his constituents have a rather uniform opinion—93% oppose admission of Red China to the UN; 78% favor ending government competition with private enterprise. But on other questions Mr Osmers might as well use his own judgment—36% favor and 34% oppose pensions for all World War I veterans; 36% favor and 38% oppose defending the independence of Israel.

When a Congressman or Senator supports federal power claiming that it is for the good of the "people," let the utilities in his district challenge him to follow the example of Representative Osmers. Let the "people" voice their opinions. Many of our Congressional leaders might be surprised to find out just how the people view their stand on various issues.

Don't Fail to Vote

ELECTRICAL WEEK



OUTPUT

Week ended Oct. 27, 11,391,000,000 Kwhr Up 6.9%

Atomic Energy Commission requirements—1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 6.8%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Oct. 27	+6.9	+7.3	+5.5	+5.6	+7.3	+5.9	+11.6	+8.6	+10.8	+7.8
Oct. 20	+6.5	+4.5	+3.4	+4.5	+8.6	+4.8	+18.0	+7.8	+13.5	+6.6
Oct. 13	+6.6	+5.8	+3.6	+5.9	+8.8	+5.1	+15.2	+10.3	+9.6	+5.7

Seasonally Adjusted Index 219.0 Week Ago 219.0 Year Ago 204.5

Here are the issue's highlights . . . No matter who wins the Nov. 6 election, the new Congress faces action on power bills . . . Cincinnati Gas & Electric promotes radio and television with an election tie-in . . . FPC's order to South Carolina Generating Co to slash power rates to Georgia Power brings hot protest . . . SEC won't investigate AG&E's holding company status on basis of proposed Terre Haute, Ind., plant in territory of Public Service Co of Ind. . . . Seattle Department of Lighting gives up bi-monthly billings . . . New lab can test 500-Mva power transformers . . . British writer reveals technical details of Calder Hall . . . PEA systems group studies load forecasting . . . What makes an electric company click? . . . Utilities try wooing college men with summer work programs . . . Key to good farm promotion: Informed allies.

Two strides are taken in atomic power field with completion of Battelle Institute's Nuclear Research Center and announcement that 5,000-kw Argonne nuclear power plant (near Lemont, Ill.) is slated to start operation in about 60 days. Battelle's 1,000-kw, $750,000 reactor, which uses solid U-235 fuel, is largest of the pool type in service in the U. S.

Bonneville Power Administration orders full restoration of 500,000 kw of interruptible loads for 17 plants of 13 industries beginning Nov. 1, because of favorable stream flows and rising storage reservoirs laid to North Pacific storms sweeping region. BPA expects interruptibles safe through November and no danger to firm loads through winter.

Hungary's Power Planning Bureau Manager Andras Levai discloses that the country has received first shipment of Russian parts for a Hungarian test reactor at the Scilleberc, the first Soviet-developed atomic reactor to be built outside the U.S.S.R. Hungarians believe they can cut uranium consumption in projected reactor after completion of economic studies.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire . . . FPC postpones from Nov. 5 to Nov. 7 resumption of hearings on Northwest Power Co's application for a license for proposed Mountain Sheep-Pleasant Valley hydro project . . . **New FPC assistant general counsel** is Robert L. Russell. He replaces William J. Grove who resigns Nov.16.

Interior Secretary Fred Seaton announces award of $1.2-million contract to Eagle Construction Co of Colorado for completion of 24,000-kw Glendo powerplant in Missouri River Basin project.

National Hells Canyon Association challenges legality of Idaho Power Co's license to construct three dams at Hells Canyon. The federal dam proponents ask for rehearing before all nine judges of Court of Appeals to reverse decision made earlier this month by three-judge panel which upheld FPC licensing of project.

Southern California Edison announces 10 to 18-year pact with El Paso Natural Gas, Southern California Gas, and Southern Counties Gas Co of Calif for new supply of natural gas to be used as fuel in its steam plants in Los Angeles area. Cost of supply estimated from $300-$400-million over contract period.

First Boston Corp group wins $28-million Ohio Power Co first mortgage 4¼% bonds (Aa) due 1986 at 100.039; re-offers at 100.848 to yield 4.20%. Company rejected two bids on sale of 60,000 shares of its $100 par preferred stock because officials felt rates in the market had been affected by the Israel situation. Eastman Dillon and Salomon Bros bid $100.51 a share for a $4.92 dividend and Harriman, Ripley and Stone & Webster Securities bid $100.34 for a $5 dividend . . . Kidder, Peabody & Co group offers 100,000 shares Texas P&L $4.76 preferred stock at $100 a share.

New third-quarter orders reach record high for Westinghouse, still recovering from effects of the long strike. The company posted a third quarter net of $10.3 million equal to 59¢ a share compared to earnings of 84¢ a share in third quarter of last year. For nine-month period, loss has been $1.4 million.

ABOUT PEOPLE IN THE INDUSTRY

The $350,000 state loan granted New York Power Authority "will speed up the development of Niagara by at least six months," claims **Gov Averell Harriman.** He said the loan, designed for preliminary work on the project, would be made available immediately. Meanwhile, actual development awaits decisions as to FPC's power to grant the license. Hearings on the 6-year controversy are slated to get underway Nov. 14 (see p 9).

"The economy of the Snake River valley has a bright future," predicts Idaho Power Co Pres **T. E. Roach.** "Much as the area needs new sources of electricity," he added, "the generation of taxes has become as important as the generation of power. All kinds of taxing districts . . . stand in need of the new tax revenues which will be forthcoming with power developed by private industry utilizing the savings of investors."

More News About People page 39

Let's Look Beyond the Elections

Regardless of the story the vote tallying will tell this week, the new Congress is certain to be embroiled in legislative matters affecting the electric utility industry.

The spark of life is weak in some of the perennials—Hells Canyon and Niagara, for instance. But there are other issues very much alive involving a raft of atomic energy, federal power rate, and other matters. Here is the rundown:

Atomic Power Development

Chances are development of atomic power will be the most active subject for legislation of interest to utilities. Certain to be brought up for consideration will be bills dealing with liability insurance for nuclear projects and with speeding reactor construction with federal money.

Rep Melvin Price (D-Ill.,) has indicated his intention of tackling the insurance and reactor problems in a package bill.

The need for federal liability insurance in amounts above those private insurance can provide has generally been acknowledged. But there is certain to be opposition to tying this up with a federal power reactor building program for which the need has not been generally acknowledged.

Also promised for the next session is a legislative move to reorganize the Atomic Energy Commission. This stems from a desire to separate the licensing, regulatory, policing functions of AEC from the operational, research, developmental phases. The growing atomic energy field probably will force this change sooner or later.

Hydro Development, TVA Financing

Hells Canyon and Niagara, major issues of past years, are losing their momentum.

The question of who should undertake Niagara redevelopment has been dropped in the Federal Power Commission's lap. Even if bills are introduced in the next session, and this has become almost a reflex action, Congress will probably hold back until either FPC or the courts have passed judgment.

Although federal power supporters have promised action to retrieve the Hells Canyon site for a federal dam, time is working against them as the Idaho Power Co goes ahead with its three-dam program. Furthermore, the courts have upheld the FPC license to the company.

Certain to come up again will be the Omnibus Rivers and Harbors Bill. This was passed during the last session but was vetoed by the President on the grounds a number of projects needed closer investigation. The bill called for $1.5 billion worth of flood control, navigation, and beach erosion projects. It included $112 million for Columbia River projects.

Another measure that was vetoed by the President and which is certain to be reintroduced is the bill to freeze federal power rates at existing levels.

This measure was aimed at preventing the Interior Department from proceeding with an announced intention of seeking increases on Southwestern Power Administration rates.

TVA bond financing may come up for airing again. No action was taken in the last session on several bills dealing with this subject. As the matter stands now TVA has authority under an appropriation measure to use power revenues to build additions to the John Sevier steam plant. But the question of TVA's future expansion and the method of financing it, is bound to be a matter of hot debate early next year.

Hoover Report, Taxes

There may be attempts to legislatively implement some of the Hoover Commission recommendations on water resources and power.

Finally, the tax amortization provisions may be the subject of legislative action. This will be aimed at removing the authority of the Administration to grant five-year tax amortization—a program under which utilities are still being aided. New applications, however, are no longer being accepted.

What's Ahead for the New Congress?

Atomic Energy

- Liability insurance for privately owned nuclear power plants
- Federal program for power reactor development
- Possible reorganization of Atomic Energy Commission

Hydroelectric Development, TVA

- Omnibus rivers and harbors bill
- Federal power rates increase
- TVA construction financing

Hoover Report, Taxes

- Bills to implement power recommendations of the Hoover Commission report
- Investigation of fast tax amortization program

Election is Theme of CG&E Promotion Scheme

A unique coupling of politics and appliances—featuring election campaigns from 1824 to the present—is the theme of Cincinnati Gas & Electric's current radio-TV promotion.

Entitled "Political Americana," the dual-purpose promotion featured a "Let's All Vote" contest that enabled winners to have their picture taken shaking hands with the wax figure of Ike or Adlai.

The contest was held in conjunction with American Heritage Foundation's "Get Out the Vote" campaign. Each contestant received a Voters Check List and a "Let's All Vote" button. Picture winners were determined by a "glowing bulb" on the check list. All contestants were eligible to receive the grand prize, a $600 color or black and white television set.

The entire Radio-TV promotion was designed primarily to sell people on the idea of a choice of programs for every member of the family through the purchase of a second TV set. About 40 TV sets, showing a variety of new features—including technical advances and new decorative schemes—were featured in the display, along with the newest in radios, phonographs, and hi-fidelity equipment.

MACHINE from McKinley-Bryan election is part of "Political Americana"

Another highlight of the exhibit was a record, "Eleven Presidents Speak", which enabled visitors to hear the recorded voices of all the presidents from Grover Cleveland to the present day.

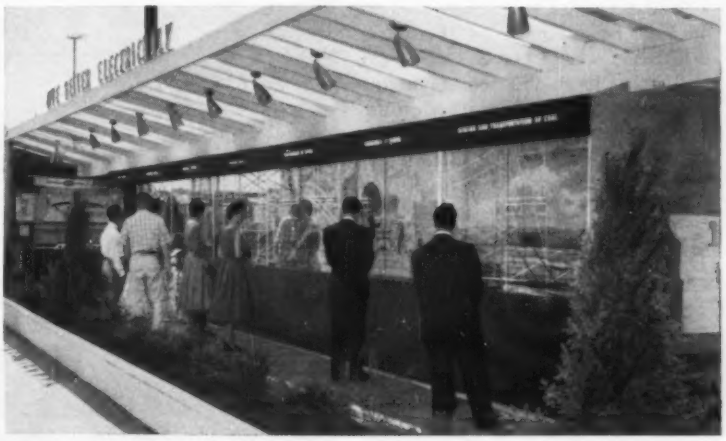
FPC to Take Up Issue of Who Develops Niagara

The Federal Power Commission will begin hearings Nov. 14 on the question of its authority to issue a license to New York State Power Authority to undertake Niagara Falls hydro development.

At the heart of these hearings will be the question of whether the 6-year-old Niagara issue will be resolved once and for all. Congress so far has failed to do anything. Now the courts, by implication, are to be given a chance. But the court route starts with what FPC decides to do.

Eight interveners will state their opinions on whether the 1950 Senate reservation in the treaty with Canada is valid. This reserved to Congress the right to decide who should handle redevelopment of Niagara.

The interveners include: Niagara Mohawk Power Corp, New York's Attorney General, National Rural Electric Co-op Assoc., Rochester Gas & Electric Co, City of Niagara Falls, American Public Power Assoc., N. Y. Municipal Electric Utilities Assoc., and City of Jamestown.



80-Ft Pavilion Plugs Electrical Living

"Live Better Electrically" got a strong plug recently at the Mid-America Jubilee, a business and civic exposition staged at the St. Louis riverfront. Union Electric Co used an 80-ft-long pavilion to do the plugging.

Part of the exhibit was a panel display (above) depicting each stage of power production from coal to kilowatts. Other displays featured the many present and future uses of electricity, and a model of a nuclear power plant illustrated the development of atomic power.

A 12-foot, neon-outlined figure of Reddy Kilowatt revolved above the display atop a 50-ft pole.

Rate Cut Decision Protested

FPC orders $252,186 annual reduction in South Carolina Generating Co's sales to Georgia Power

Federal Power Commission decision ordering South Carolina Generating Co to slash its rates to Georgia Power Co by $252,186 a year brought a sharp protest from SCG Pres S. C. McMeekin. He charged the order conflicts with Supreme Court decisions and encroaches on the right of free negotiation of contracts.

The South Carolina firm, a subsidiary of South Carolina Gas & Electric Co, contended during the hearing that the case closely parallels that involving Pacific Gas & Electric Co sales to Sierra Pacific Power Co. In the PG&E case, the Supreme Court ruled that a wholesale power contract is valid unless it is clearly against the public interest. In the present case, an FPC examiner had ruled against the rate cut, only to be reversed by a four-man majority of the commission. Commissioner Seaborne L. Digby dissented from the finding.

At issue in the rate matter was "cost of service" vs "fair value." SCG maintained that its rates represented a "fair value" of the service rendered. But FPC majority contended that the "cost of service" formula is best adapted in determining just and reasonable rates in this instance where all costs are known or clearly determinable.

FPC said the value of service approach would result "in a chaotic (rate) structure." It maintained further, that this would be no regulation at all and would completely disregard public interest and the ultimate consumer which the Federal Power Act is designed to protect.

Commenting on the FPC action, Harllee Branch Jr, president, Georgia Power Co, said the order upsetting the power contract between SCG and Georgia Power "poses a serious problem for our company."

"If South Carolina Generating should elect to discontinue supplying us with the 75,000 kw of capacity now available under the contract," Branch continued, "we will be forced to look elsewhere for substitute power. It appears doubtful that we can obtain power on as favorable terms from other utilities or from a plant built by us at today's higher construction costs."

SCG supplies power to three customers from its 274,000 kw Urquhart steam plant. The customers are Georgia Power, South Carolina G&E, and E. I. duPont Co as prime contractor for the Atomic Energy Commission's Savannah River Plant at Aiken, S. C.

The rate case was instigated by the Public Service Commission of Georgia.

SEC Won't Investigate AG&E's Holding Co Status

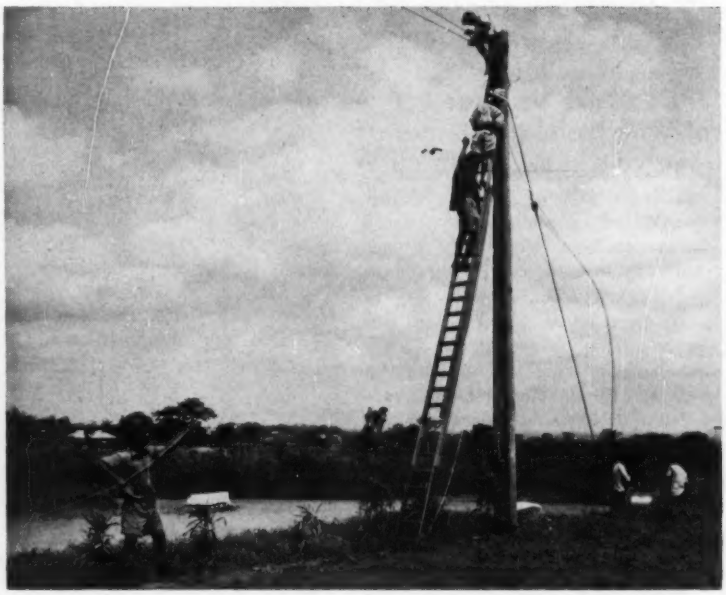
The Securities & Exchange Commission has declined to investigate whether American Gas & Electric Co will violate its holding company status by building a new steam plant on the Wabash River in Public Service Co of Indiana's area (EW, Oct. 8, p 8).

PSI claimed that the station (to house the first of AG&E's pioneer 450-Mw units) would put Indiana & Michigan Electric Co in a position to give service in PSI territory.

But SEC replied that no statute requires all generation and transmission facilities of an integrated system to be entirely in the utility's own area.

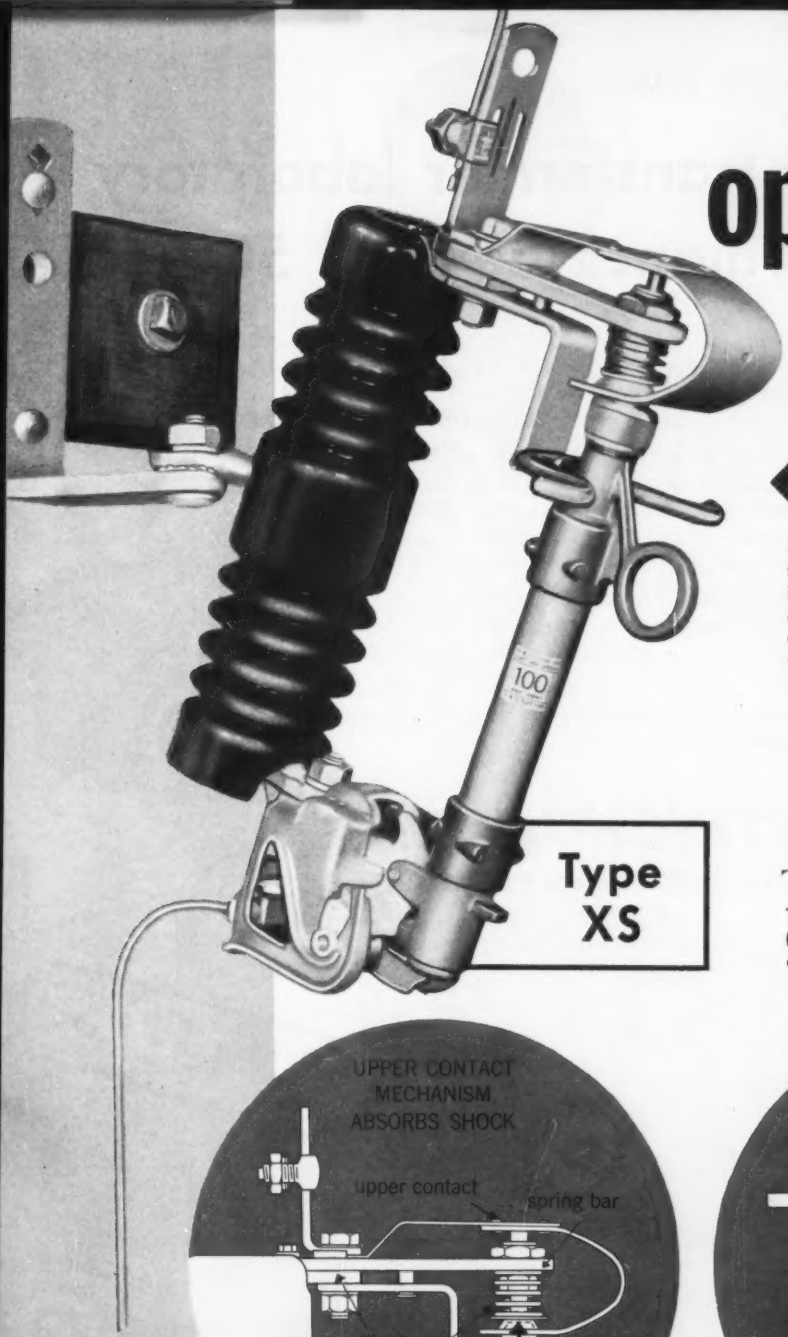
SEC said further that it could find no basis for concluding that the proposed plant would expand the AG&E system beyond permissible limits. It added that proceedings can be initiated at any time if I&M tries to give service in PSI territory.

The Public Service Commission of Indiana and the State Corp of Virginia both intervened on grounds that the matter fell within their jurisdictions, and not that of the SEC. But SEC said it solely has responsibility of determining whether a holding company conforms to the law.



Concrete Poles Serve Togoland

Work is progressing steadily on the Ho Electricity Supply serving Trans-Volta-Togoland (Gold Coast, Africa). Distribution poles such as the one shown here were molded locally of reinforced concrete. Barefoot linemen use ladders to work on pole's hardware. The distribution system being built will be served by a new station, also under construction, which will take initially two 95-kw machines.



A SINGLE-VENTED

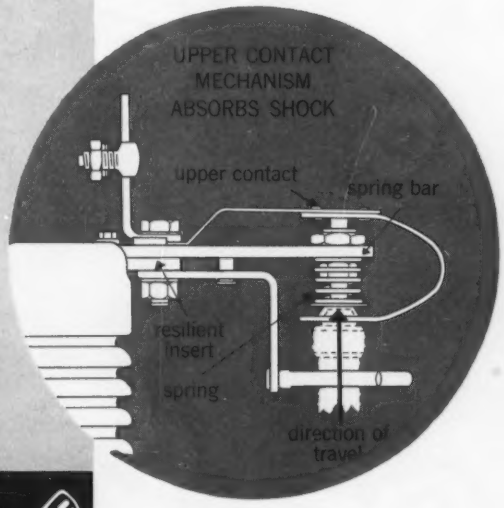
open cutout

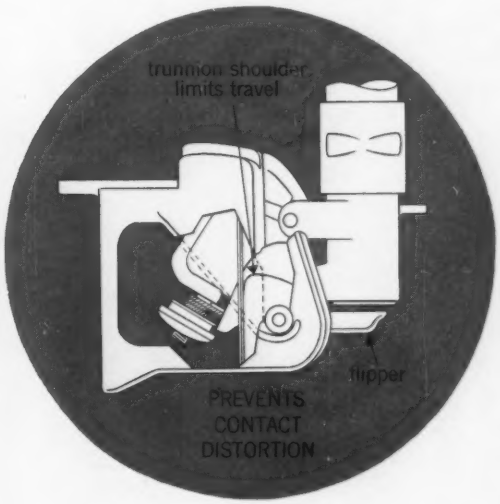
that will clear 12,000 amperes!

Significant new* developments by S&C now take the open cutout to exceptionally high levels of interrupting capacity without sacrificing low fault current interruption ability, without added cost, without double venting, and without disregard for linemen's safety.

- ✻ Controlled placement of fuse link shortens arc length — reduces gas generation.
- ✻ Multistep recoil action (from recoil bar, spring, resiliently mounted insert, contact) absorbs energy when fuse blows.
- ✻ Supplemental recoil action, when trunnion engages hinge casting, dissipates remaining energy.

The XS may be closed on 12,000 ampere faults (7.5 kv rating). And the patented "flipper" feature assures reliable interruption of low-current faults.





S&C

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

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POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

NEWEST WESTINGHOUSE TEST CENTER . . .

World's largest transformer laboratory to prove performance beyond 500,000

Here's a Westinghouse investment that is now adding value to every dollar you put into Westinghouse power transformers. In one vast new facility is a combined commercial and experimental testing laboratory at the Transformer Division, Sharon, Pa.

From this ultramodern laboratory, used primarily for research and development, will come transformers of the future. The new anechoic vault, for example, will make complete sound measurements to and beyond 500,000-kva ratings; find ways to throttle structural resonance; ferret out strengths and weaknesses of new core materials and processes; speed inquiry into new methods of reducing vibration and sound.

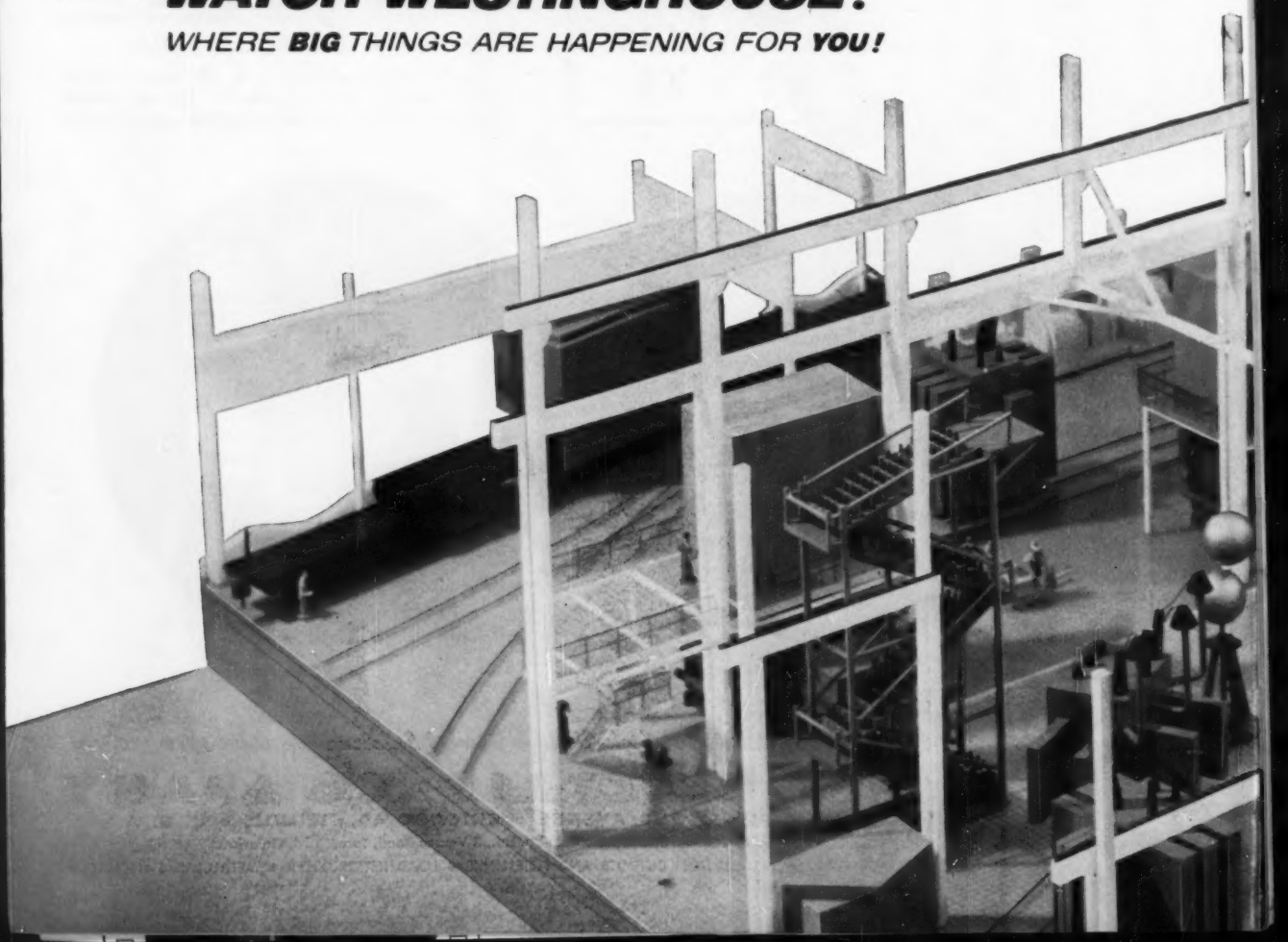
In the high-voltage laboratory, new insulation systems are being developed. Here, models — and full-scale transformers — are tested to destruction. This laboratory is equipped, in fact, to evaluate total electrical performance of the largest commercial units predicted for a decade ahead.

Here today is equipment that immeasurably strengthens the promise of performance in things to come — from Westinghouse.

J-70783

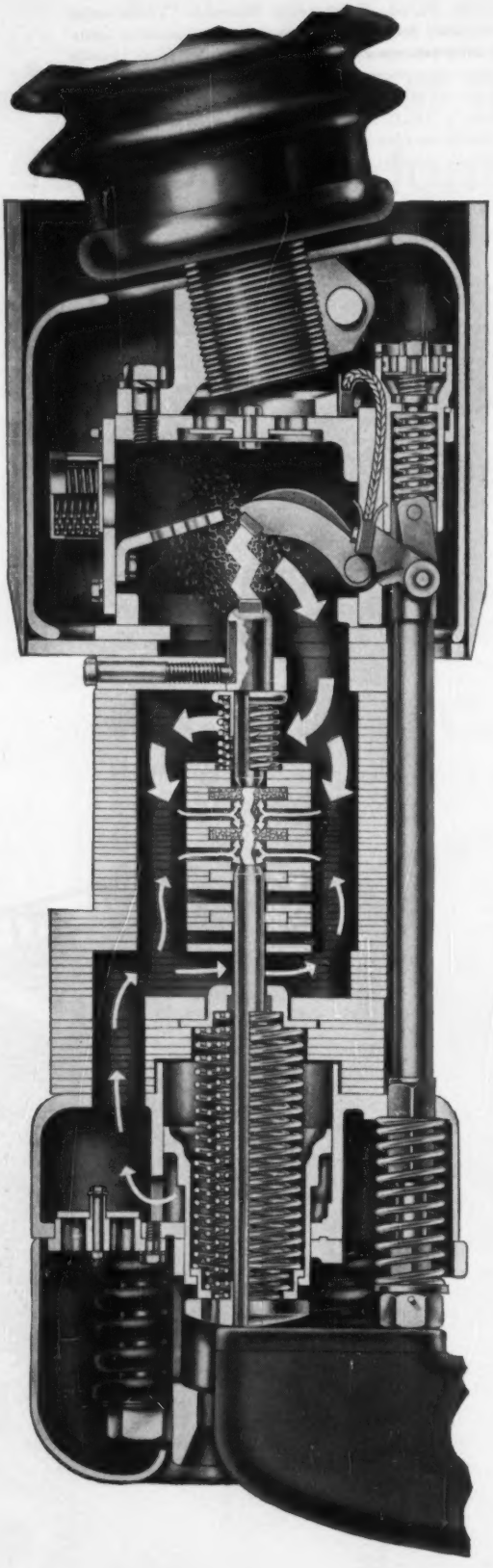
WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING FOR **YOU!***



KVA

M. E. Fagan, Engineering Manager, Transformer Division, and model of world's most modern transformer laboratory at Westinghouse. Facilities include surge generators at 600,000, 4 million and 5 million volts; a 1,050,000-volt, 60-cycle test set for insulation; a 180,000-ampere impulse generator; a completely shielded sound chamber for radio interference testing of small power transformers and components.



No other interrupter offers all this

Greater system stability . . . duration of faults is sharply limited, thus keeping them from lowering effective machine voltages and reducing synchronizing power. The result is better service continuity.

Shorter arcing time . . . plenty of fresh oil is brought across the entire arcing path, cooling the arc and removing ionized gases. Insulation is increased so that the arc cannot re-establish itself after current zero.

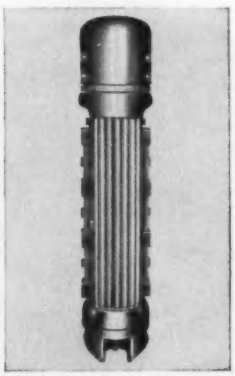
Reduced arc energy . . . arcing time and arc length are reduced. An arc so restricted has low arc voltage, low energy.

Lower maintenance . . . low arc energy during interruption limits oil carbonization and lengthens contact life. The entire grid is designed for easy, simplified inspection of contacts and parts without dismantling.

Longer oil life . . . carbonization is reduced, interruption quicker. "De-ion®" grid breakers maintain necessary insulating level through more interruptions than other types.

High-power laboratory tested . . . complete verification of all interrupting ratings.

Here is reliability that means freedom from the inconvenience and worry about faulty operation. De-ion grids have proved, through years of trouble-free service, that they can be depended upon to do their job quickly and efficiently. J-60889



Above is a cutaway view of the Multiflow grid showing the path of the oil in quenching the arc. The Multiflow grid is used on breakers rated 69 kv and above. At the right are the Magnetic and Tubular grids used in breakers rated 69 kv and below, and high capacity 138 kv and above, respectively. These grids have proved, in service, that they have no equals in efficiency and reliability.

WATCH WESTINGHOUSE!

*WHERE **BIG** THINGS ARE HAPPENING **TODAY!***

A Solar Still . . .

"Revenoo" agents won't be interested in a solar still which may be operating near San Diego, Calif., within three months. This still, if no legal hitch develops, will convert salt water to fresh at a 500-gpd rate. The experimental seawater conversion plant is to be situated on a 4.9-acre site at Ocean Beach.

Willis T. Moran, chief chemical engineer for the U. S. Bureau of Reclamation said the installation will consist of a series of saucer-shaped concrete slabs covered with glass, a greenhouse-like structure, and a small office. A lease is now being negotiated for the land.

Dispute in the Valley

Tennessee Valley Authority Board Chairman Herbert D. Vogel has denied charges that he advocates a policy that would increase cost of electricity in the valley by $30 million, and add $1.6 million to the price of the current load in Chattanooga.

S. R. Finley, general superintendent of the Chattanooga Electric Power Board previously had charged that General Vogel has advocated that TVA should earn 6% on its investment instead of the 4% earned for the past decade. Said Finley: "It is good to know that he is not advocating it now."

Exit Bi-Monthly Billings

Most of Seattle Department of Lighting's electric heating customers will go back to monthly billings soon. The change is being made at the request of many customers who say that it works a hardship on them to pay two-month bills during the heating season. The change will affect about 4,000 accounts.

Draining a Lake

Engineers of the Salt River Power District, Phoenix, Ariz., report that Canyon Lake will have to be drained from its present 53,000-acre-ft level to 800 acre ft to enable crews to repair a leaky butterfly valve at Mormon Flat Dam. A trash screen will be replaced at the same time. Considerable debris had lodged in the screen following a "vicious" storm two years ago. The debris-choked screen is curtailing efficient operation of the hydroplant.

No water will be wasted in the draining operation, however. It will be passed through generators into the reservoir impounded by Stewart Mountain Dam—coinciding with routine irrigation water orders from farmers in the valley. By Jan. 1, Canyon Lake should be low enough to enable the three-week project to begin. Then water from Horse Mesa Dam will be released through the generator to build up Canyon Lake. This will take about two months, the engineers say.

Dam-Building Sidelight

City Light of Seattle, Wash., may be opposed by mining interests if it fails to provide protection to mining properties under the reservoir that would be created by its proposed $140-million, 540-Mw hydroelectric project on the Pend Oreille River in northeast Washington. In hopes of avoiding a tie-up, City Light devised this scheme to prevent reservoir water from flooding mines:

Twin tunnels, each 2 mi long and 100 ft beneath the river, will be bored opposite present mine workings 6 mi above the dam. Using the tunnels, men will find and seal off any faults which might enable water to leak from the reservoir into the mines. Cost of the project: An estimated $4.3 million. City Light Supt Paul R. Raver pledged in addition to keep the tunnels 3,000 ft ahead of mine workings if the latter move closer to the dam.

Gasified Coal Plant

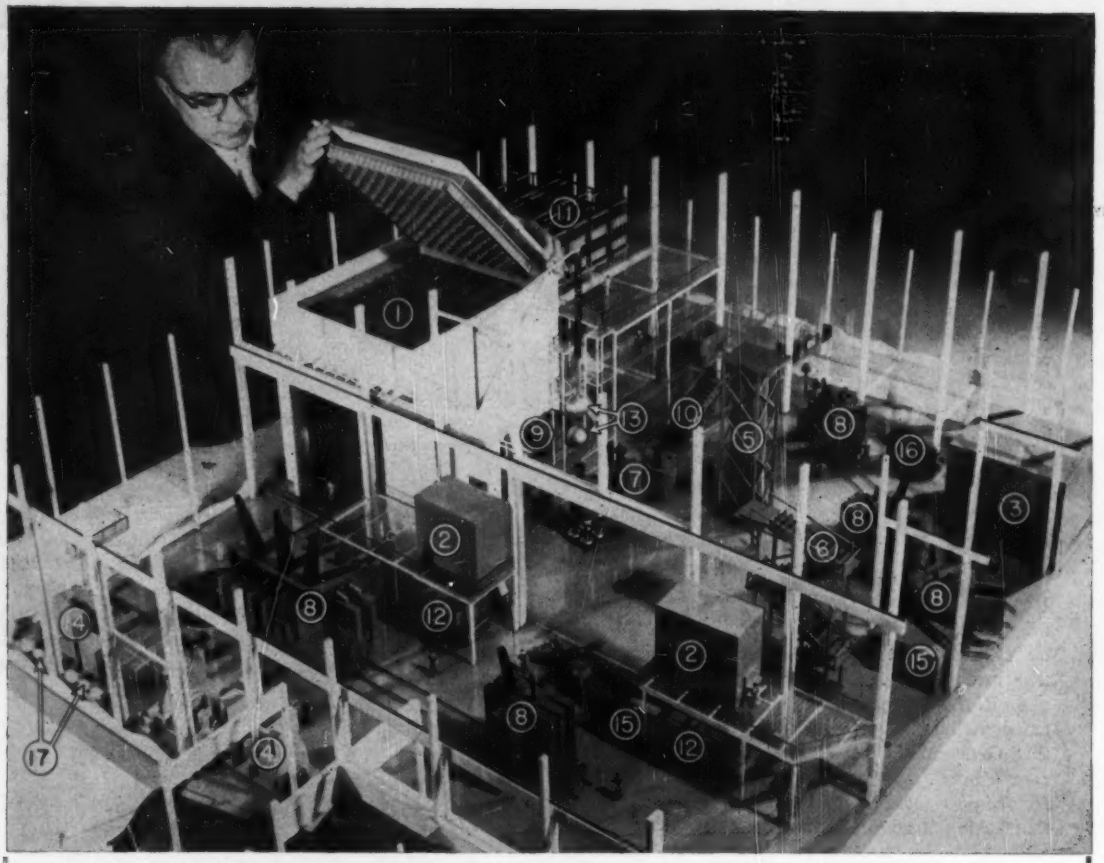
England's National Coal Board is moving ahead to carry out its part in the creation of an experimental power plant to use coal burned underground. Newman Spinney in Derbyshire is likely to be the site chosen for the pilot station. It is one of the sites at which trials already have been run for six years by the Ministry of Fuel and Power. Cost of the project is not yet determined.

Several years are expected to elapse before a full-scale commercial plant can be brought into operation. But the new pilot plant will enable engineers to explore coal gasification schemes on a commercial scale.

Britain's largest single trial system so far has maintained a rate of about 20 tons of coal gasified a day. This is enough to generate 800 kw. Over a trillion cu ft of gas have been produced from 5,000 tons of coal at Newman Spinney. Total expenditure on all trials has reached $2.1 million.

Electric Town

Othello, Wash., (pop. 2,080) on the fringe of the Columbia Basin irrigation project, claims to be the "most electric" town in the U. S. Its 406 residential customers of Washington Water Power Co used an average of 8,310 kwhr each during 1955. Only three houses still have two-wire services. About 97% of the customers have electric water heating. No gas is used for cooking or water heating—either residential or commercial.



Westinghouse's Transformer Test Center Provides These Facilities:

1 Anechoic vault
2 Test booths
3 Radio-influence room
4 20,000-kva motor-generator set
5 5,200-kv surge generator
6 4,000-kv surge generator
7 1,050-kva 3-unit cascade transformer
8 Transformers to be tested
9 Power filters for sound room
10 600-kv surge generator
11 Capacitor banks
12 Power regulating transformers
13 200-cm sphere gap
14 Master switchgear
15 Control rooms for surge generators
16 180,000-amp current generator
17 Auxiliary motor-generator sets

New Lab Can Test 500-Mva Units

Complete commercial and development tests can be made on transformers rated 500,000 kva and above at Westinghouse Electric Corp's new test center at Sharon, Pa.

The $3.5-million test center is the final part of a $13-million program which enables the Transformer Division to turn out 30% more power transformers. The expansion included construction of a 200,000-sq ft steel fabricating shop and additions of 150,000 sq ft to eight buildings.

The test center consolidates four types of related test facilities into a single compact working area. They are: (1) a giant anechoic vault, (2) a high-voltage development laboratory, (3) a special room for measuring radio-influence voltages, and (4) a commercial test floor.

This equipment is sufficient to make complete tests including power loss measurements, temperature runs, sound level measurements, and impulse tests on assembled units rated in excess of 500,000 kva. Although many commercial tests will be conducted, the center will be used primarily for research and development. It will aid in designing more efficient and quieter, yet smaller and lighter transformers.

The developmental test bay is used primarily for testing insulation structures of various materials and configurations. There, several high-voltage and radio-influence tests are performed. Many insulation models and full-scale transformer models are evaluated by testing them to destruction.

This makes it possible to verify the adequacy of the insulation combinations being investigated.

Non-destructive development tests and low-voltage surge tests for determining voltage distribution and stress are conducted on commercial units in the radio-influence room.

A maze of problems is yet to be explored with these new facilities. The hoped-for end results of the developmental tests are better products and measurement techniques.

Commercial tests can be conducted simultaneously on two transformers at the two stations in the commercial testing aisle. First the transformers undergo a series of 60-cps tests such as loss measurements, temperature runs, and power factor measurements. Then they are impulse-tested with the 4,000-kv surge generator.

Applied potential tests are conducted on high-voltage windings using the 1,050-kv, 60-cps rms, 3-unit cascade transformer set-up. And induced tests are run at 120 cps, 180 cps, and other frequencies above 60 cps.

While the units are in the commercial testing aisle, they are given other electrical tests such as tests on auxiliaries, tap-changing equipment, and control line. Then, if sound level tests are desired, the transformers are lifted onto buggies and rolled into the anechoic vault.

Anechoic Vault Is Impressive Structure

The anechoic vault is the most predominant single section of the test center. It is a 70-ft-long, 56-ft-wide, 57-ft-high reinforced-concrete-and-steel structure.

By using massive exterior construction combined with double walls and low-frequency sound-absorbing linings, Westinghouse attained a noise level of 30 db inside the vault. This compares with 85 db immediately outside.

The walls are nearly 5-ft thick. Each wall is composed of 12 in. of concrete, a layer of galvanized sheet steel, a 2-in. blanket of glass fiber in a 9-in. air space, and a lining of 3-ft-thick fiber glass wedges.

The solid layer of steel that lines the inner wall of the concrete structure shields the room to permit radio-influence measurements on large transformers. RI attenuation in the vault is more than 100 db from 15 kc to 1,000 Mc.

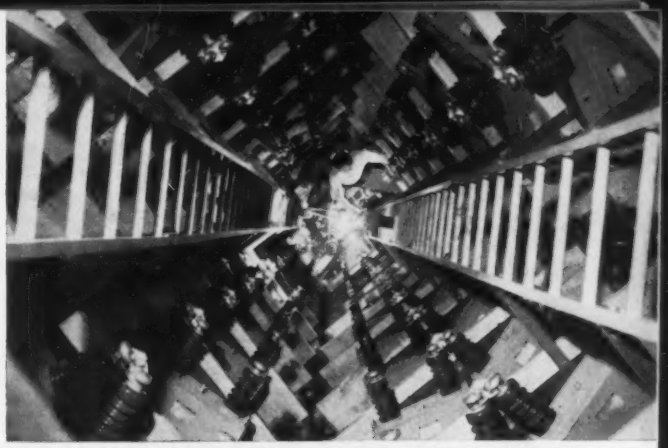
To reduce transmission of earth-borne noise and vibration, the vault is isolated from the main building structure. Its 1,200-ton, 4-ft-thick floor slab is supported on concrete piles to give it sufficient mass and inertia.

Seek Way to Reduce Noise from Auxiliaries

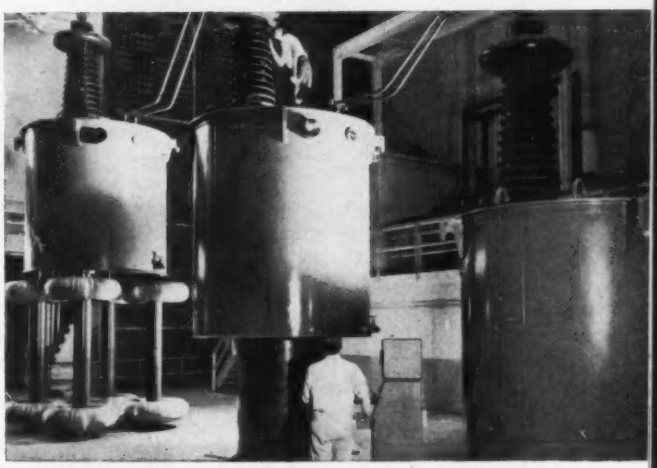
In the basic anechoic tests, the average noise level about the transformer is measured using the "A" and "C" frequency-weighting networks of a decibel meter. The noise is analyzed by narrow-band, octave-band, or one-third-octave-band analyzers. When a particular transformer is studied, deviations of its spectrum from that of a normal quiet transformer indicate resonance and strains.

The vault is also used to find ways of reducing noise from auxiliaries such as fans, pumps, and tap changers. Since tap changers have an impulse type of noise, it is advantageous to record the sound with a high-speed graphic recorder and to observe it on a single-sweep, long-persistance oscilloscope. The sound is recorded on tape, a tape loop is made, and the sound is analyzed as usual.

The vault permits investigation of special problems such as the possibility of using sound-absorbing materials inside oil-filled transformers. If proper materials can be found, the noise level can be reduced by as much as 10 db.

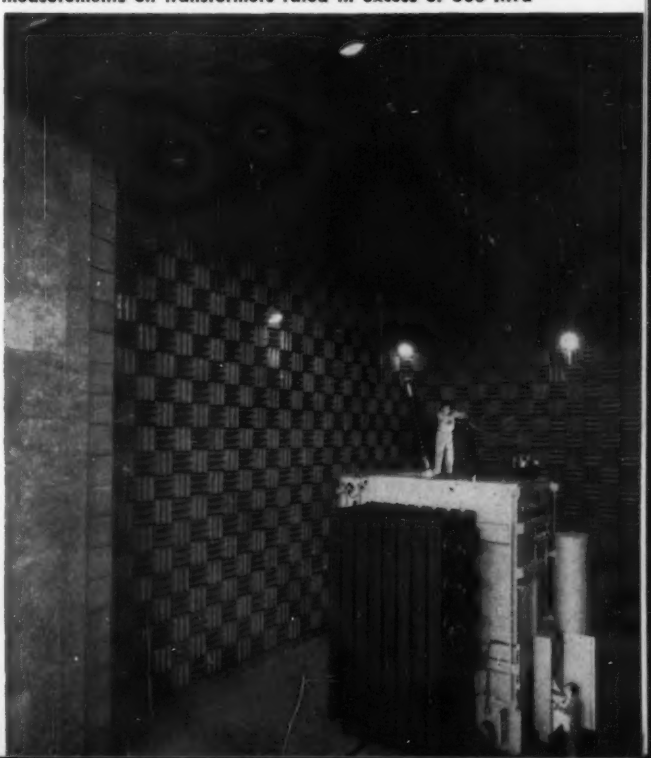


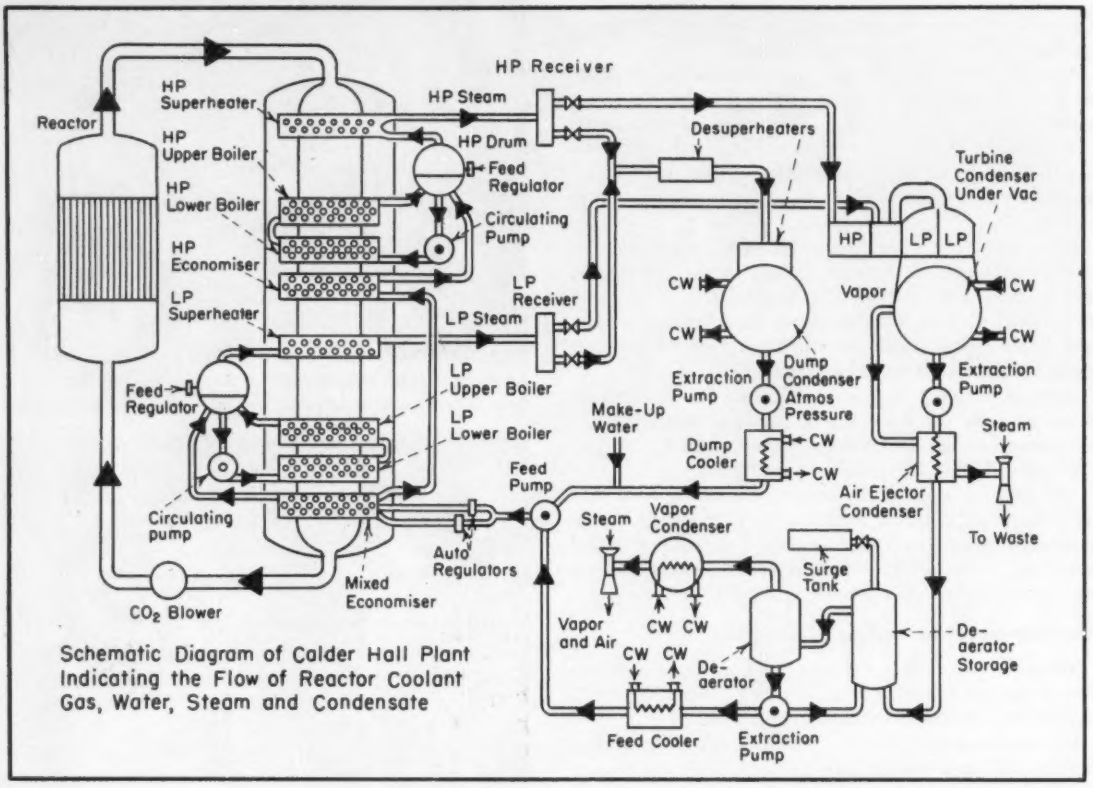
5,200-KV SURGE GENERATOR is used primarily for testing new insulation structures of various materials and shapes



CASCADE TRANSFORMER employs three units to build up to 1,050 kva at 60 cps for development and commercial tests

GIANT ANECHOIC VAULT is used to make complete sound measurements on transformers rated in excess of 500 Mva





Schematic Diagram of Calder Hall Plant Indicating the Flow of Reactor Coolant Gas, Water, Steam and Condensate

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Calder Hall: Birth of New Technology

EW's profile of England's Calder Hall nuclear plant (Oct. 15, p 122) details economics of the project. Here are technical data omitted from the earlier report.—Ed.

J. H. M. SYKES, Bedford, England

When Queen Elizabeth II tripped a circuit breaker at 12:12 p.m. Oct. 17, she diverted about 10,000 kw being produced at the Calder Hall Atomic Power Station in Cumberland, England, into the British national grid network. In this historic move, she coupled a commercial-scale (92-Mw installed capacity) atomic power plant into regular commercial service.

At that time, the first of Calder Hall's two reactors was in commission. The second is to operate commercially in a few months.

Calder Hall contains two complete stations—Calder A and Calder B.

Calder A, opened by the Queen, holds two reactors, each having four heat exchangers and four main carbon dioxide blowers, arranged either side of a turbine house equipped with four 23,000-kw alternators, and two dump condensers. The station has two cooling towers.

The four reactors of Calder A and B will require about 40 Mw (mainly absorbed by four centrifugal blowers in the heat exchanger circuits, absorbing 5.44 Mw per reactor).

Main limiting factors are the size and strength (to resist internal gas pressure) of the steel reactor vessel, in the light of current welding art and the allowable temperature of the fuel element cans.

The 2-in. thickness of steel plate for a vessel having a total intercal volume of 57,500 cu ft, an inside diameter of 37 ft, and a height of 71.5 ft was considered the largest size of plate which could be successfully precision-welded. This limited the internal pressure of the gas coolant to 100 psig, and this in turn limited the heat transfer rate with respect to the carbon dioxide flow into the heat exchanger.

The Calder Hall reactors consist basically of a steel pressure vessel into which is built a graphic structure housing the fuel elements. The pressure vessel sits vertically (a departure from previous practice in research reactors of similar type).

The graphite blocks sit on flat steel plates set on a steel grid supported around its periphery in the vessel. The graphite core height is 21 ft, and it has a 31-ft diam. There are 1,696 fuel element channels.

A thermal shield of 6-in.-thick steel plate surrounds the reactor pressure vessel. A 7-ft-thick concrete biological shield encloses the entire pressure vessel.

The pressure vessel's domed top contains a large number of extended tubes passing through the biological shield to caps on the roof, through which charge and discharge operations

(*Continued on page* 26)

"I'll be right down, Joe... These PLP DEAD-ENDS are a cinch to install"...

Installation of a PLP Dead-End is no trick at all. It's fast and it's done right the first time, by hand. No need to recheck later.

The resulting installation is neat . . . safe . . . permanent.

The streamlined appearance speaks for itself. Safety is assured because there are no sharp edges, no concentrated stress or fatigue point.

A speedy installation, and trouble-free service are reasons why linemen prefer PLP Service Entrance Dead-Ends. Call a PLP Representative today, ask for a demonstration.

PX-76

Made in accordance with or for use under U S Patent No 2,761,273; other patents pending.

PREFORMED LINE PRODUCTS COMPANY

5349 St. Clair Avenue — Cleveland 3, Ohio

TELEPHONE: CLEVELAND EXPRESS 1-3571

An example of Allis-Chalmers leadership

This new neighbor won't bother anyone

New low-sound-level 125,000-kva transformer built by Allis-Chalmers for Wisconsin Electric Power Company bulk station in residential area.

Even residents of homes only 300 feet away will have no reason to complain about this good neighbor. It was specially designed to create good will.

Because of the location, Wisconsin Electric Power Company required a transformer with a low noise level.

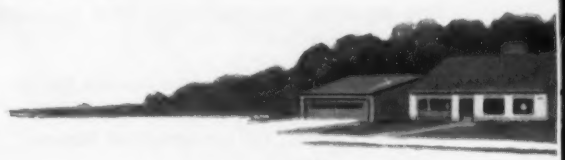
After careful study of the area, Allis-Chalmers designed and built a unit with frequencies melded to the ambient.

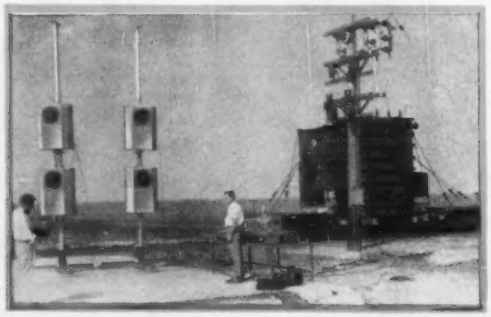
In addition, tests show that such factors as temperature rise, auxiliary losses and operating efficiency are extremely favorable.

This installation is assurance that, where low noise level is important, you can look to Allis-Chalmers.

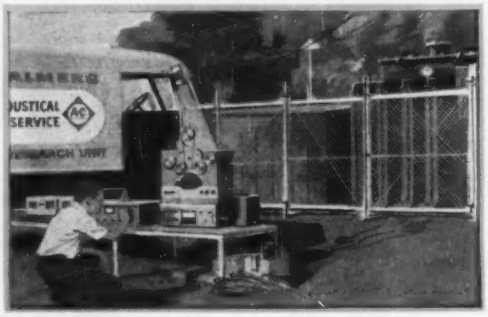
Transformers like this are an outgrowth of continued research by Allis-Chalmers into magnetostriction and resonance in the A-C Sound Laboratories, the Mobile Research Unit and the Acoustical Proving Ground.

For help in finding the best and most economical means for solving a sound problem, contact your nearby A-C office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.





Ten-acre acoustical proving ground provides first *practical* means for sound-level testing. Equipment on hand includes means for duplication of any area acoustically.



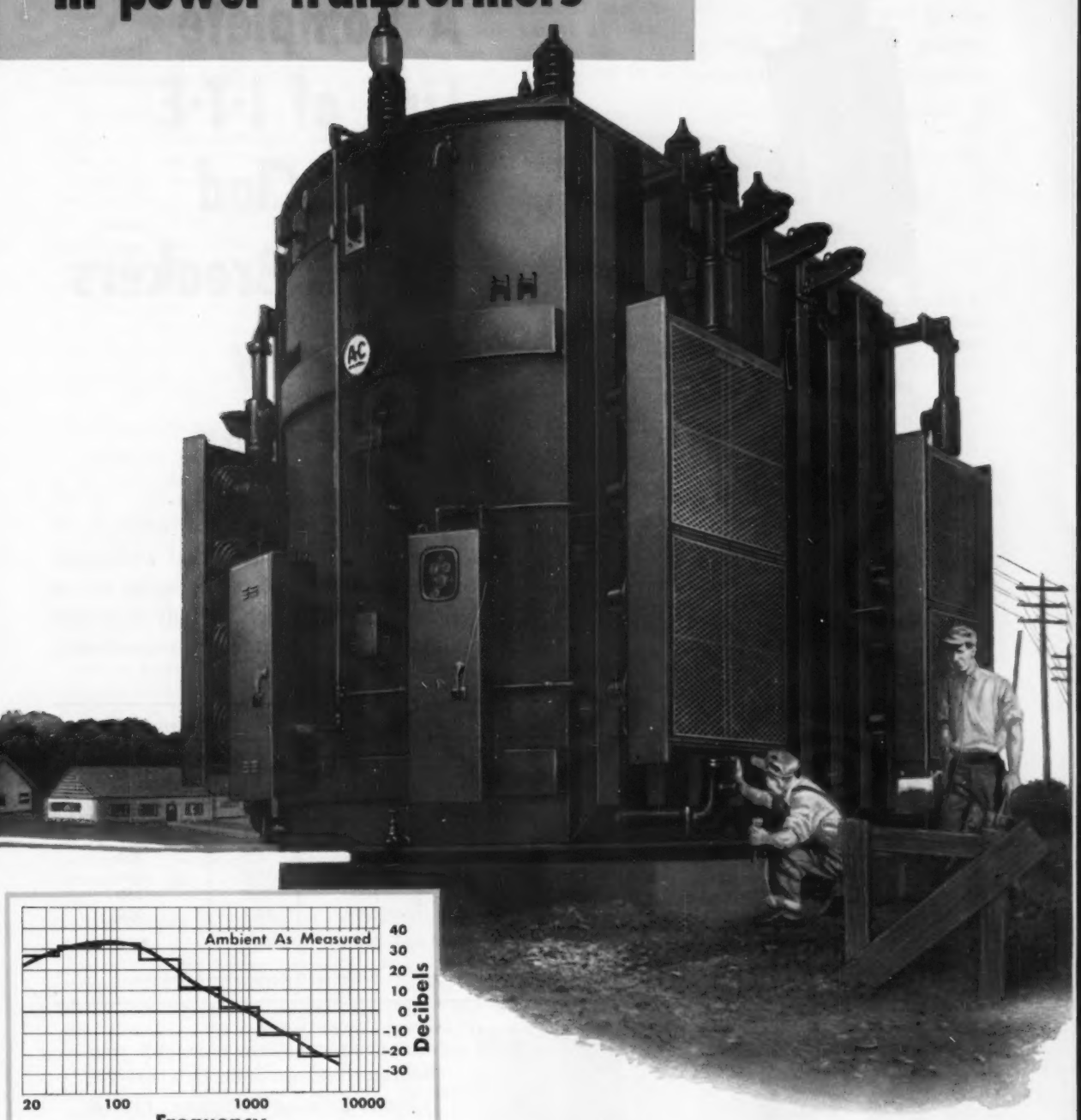
Mobile sound research laboratory unit can bring laboratory equipment to where substations are planned . . . helps you decide sound level of transformer.

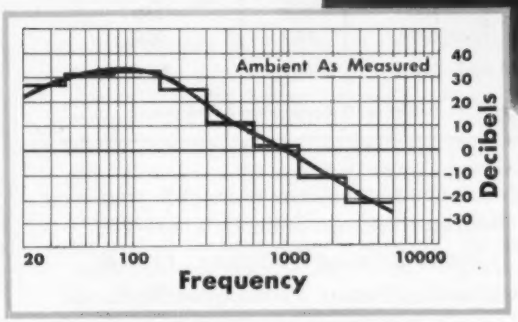
A-5225

A-C ALLIS-CHALMERS

ALLIS-

in power transformers

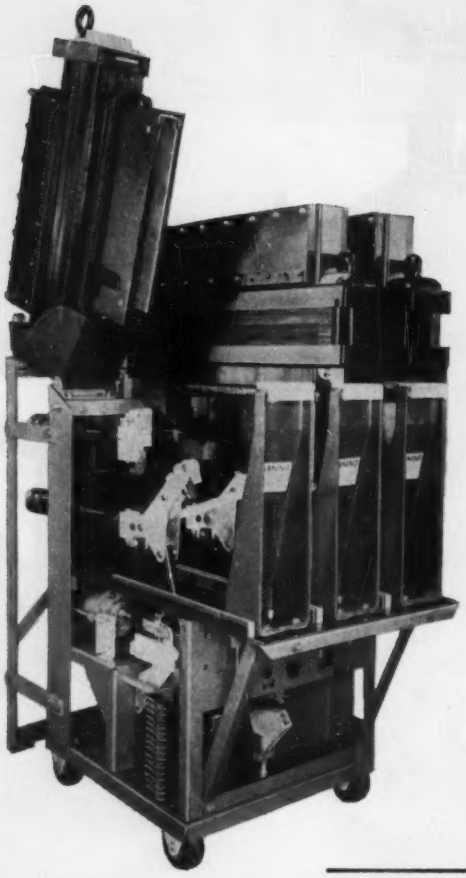




Testing at 2:00 a.m. determined maximum masking noises . . . helped determine noise level which transformer could have without creating complaints from nearby residences.

Low sound level is feature of new 125,000-kva Allis-Chalmers transformer being installed in residential area.

CHALMERS



A Complete Line of I-T-E Metal-Clad Circuit Breakers for Every Application

Anticipating the proposed addition of three new higher metal-clad switchgear ratings, I-T-E now has a complete line of circuit breakers which are fully developed and tested to meet every requirement.

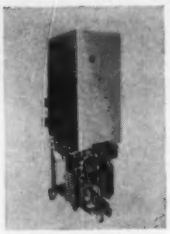
New 75 mva interrupting rating for I-T-E metal-clad switchgear applied on 4.16 kv systems

New 350 mva interrupting rating with a new 3000 amp continuous rating for application on 2.3 or 4.16 kv systems

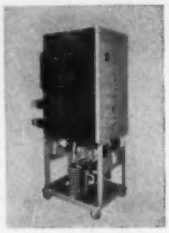
New 750 mva interrupting rating for application on 13.8 kv systems at 1200/2000 amp continuous

I-T-E Type	Continuous Amperes	Rated KV	Interrupting MVA
5HV-75	**1200**	4.16	**75**
5HV-150	600-1200-2000	4.16	150
5HV-250	1200-2000	4.16	250
5HV-350	**1200-3000**	4.16	**350**
7.5HV-250	1200-2000	7.2	250
7.5HV-500	1200-2000	7.2	500
15HV-150	600-1200	13.8	150
15HV-250	1200-2000	13.8	250
15HV-500	1200-2000	13.8	500
15HV-750	**1200-2000**	13.8	**750**

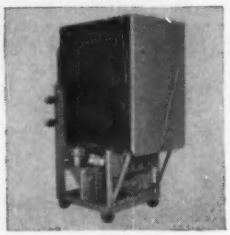
Note: These ratings require no change in I-T-E compartment dimensions.



5HV-75



5HV-350



15HV-750

For complete information, call your nearest I-T-E sales office. Or write I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY · **Switchgear Division**

War with Russia . . .

now going on in technology, Hollowell tells ASA, U. S. must evaluate Reds fairly

Economic and technological infiltration by Russia throughout many parts of the free world represents the greatest threat to this nation's security and freedom, H. Thomas Hallowell, Jr, president of the American Standards Association, told the opening session of the National Conference on Standards recently at New York.

"Even though we are not now engaged in a shooting war," Hallowell said, "we are involved in the fiercest technological competition that has ever been waged between two nations."

Don't Overrate Russians

He pointed out that our chief concern today is the possibility that there will be a lull in development of national standards, simply because the need for such standards seems less urgent.

"The development of standards in times of peace is scarcely less important than in war," Hallowell said.

Hallowell, also president of the Standard Pressed Steel Co, Jenkintown, Pa, described Russia's all-out efforts on vital crash programs of education, engineering, and production.

Standards Needed in Peace

"Russian achievements in education, production, and standardization must be taken as a serious challenge," he continued. "On the other hand, we should not be over-impressed by them."

Such methods, he pointed out, contain a strong element of eventual self-defeat. They can become too rigid, overshoot their mark, and lose completely their usefulness in relation to other elements of the economy. They rule out all forces of organic growth, adjustment, and regeneration. An error made at the heart of such a highly centralized state can convulse the entire economy.

"But a free society also has its germs of self-defeat," he warned. "They are the trends to dissipation of efforts, self individualism, and entrenchment of interests. Constant vigilance and regeneration are needed to keep the society sufficiently elastic and strong for constant progress."

Following officers of the American Standards Association were re-elected:

President: H. Thomas Hallowell, Jr, president, Standard Pressed Steel Co.

Vice-President: Van H. Leichliter, vice president operations, American Steel & Wire Division, United States Steel Corp.

Chairman of the Standards Council: Arthur S. Johnson, vice president, American Mutual Liability Insurance Co, Boston. T. E. Veltfort, manager, Copper and Brass Research Association, who is the council's vice chairman, was renamed to that post.

The following directors were elected: D. Roy Shoults, Atomic Products Division, General Electric Co, representing the Aircraft Industries Association; J. H. Foote, Commonwealth Associates, Inc, representing the American Institute of Electrical Engineers; Vice Admiral W. A. Kitts, 3rd, USN (ret), Atomic Products Study, General Electric, representing the Atomic Industrial Forum; and Harold Turner, American Gas & Electric Service Corp representing the Edison Electric Institute.

Cisler Says PRDC Reactor Can't Explode Like Bomb

Atomic-bomb-type explosions at the proposed $54-million nuclear power plant at Monroe, Mich., are "entirely impossible," said Walker L. Cisler, president of Detroit Edison Co and Power Reactor Development Co.

Referring to the reactor's safety, Cisler said, "In our minds there are no safety questions that cannot be resolved before the plant goes into operation. . . . We are having a critical assembly test made at the AEC reactor testing station in Arco, Idaho."

Testing will determine the nuclear force of this first large, fast breeder type reactor. The effectiveness of safety devices will be tested in actual practice.

In speaking to the Monroe Businessmen's Association, Cisler said that a release of heat energy would be the worst that could happen in a complete failure of the safety devices. Radioactive sodium would be contained in the reactor's gas-tight outer shell. Thus no person in the vicinity of the plant could be injured in any way. Atomic experts are in general agreement that this is true of all reactors now planned.

Vennard Warns . . .

EEI area development group is told business-run power must be made more attractive

Government power generation is a threat to all of us, Edwin Vennard, vice president, Edison Electric Institute, warned the Third Annual Workshop sponsored by the Area Development Committee of EEI in Minneapolis recently.

People Want to Get More

There is only one way to fight it, he declared, and that is to make "business-managed power more desirable to the people than government power. We must be able to contribute more to the areas we serve than a government project. If the people think they are going to get more from a government project, they will set up a municipal plant or ask for state or federal power projects. To meet this threat, we must be able to deliver more to our communities than a government project."

This is a large order, he pointed out, which "we cannot fill without adequate area development programs." He cited the advertising for any government project. For example, some of the literature put out by the Citizens for TVA. It is filled, he said, "with area development facts. The government has been cashing in on that theme."

Fight on for New Factories

Dr George Cline Smith, vice president and economist, F. W. Dodge Corp, said that various communities of the country are in the midst of the hottest competitive fight trying to get their fair share of new factories to locate in their area. Plant and equipment outlays for industry in 1957 will be about $35 billion, he estimated.

These basic factors, Smith said, point to the increasing demand for new industrial facilities:

- Population growth will continue. There are nearly three million more people around today than a year ago.
- Living standards will go higher.
- New methods and machines will speed up obsolescence of plants.
- New products will stimulate the development of new consumer goods which quickly change from luxuries to necessities. Whole new industries may result.

Operating Experience with Pressurized Water Reactor Shows . . .

A-Plant Maintenance not Excessive

GENERATION
Maintenance

60,000 manhours per year needed for primary maintenance of nuclear plant designed to produce 40 to 60 Mw of heat

R. E. CREWS, Senior Engineer—52W Project, Atomic Power Division, Westinghouse Electric Corp, Pittsburgh, Pa. and
J. M. YADON, Manager—S1W Site, Atomic Power Division, Westinghouse Electric Corp, Idaho Falls, Idaho

Experience has shown that maintenance and repair work can be accomplished on a pressurized water reactor type nuclear power plant without abnormal risk to personnel and without unreasonable expenditures of time and money, if the personnel are thoroughly qualified.

A review of operating experience has shown that, even in the beginning of nuclear power plant operation, more than 80% of non-routine maintenance and repair items involve conventional equipment. Some typical problems encountered include common items such as loose connections, manufacturing errors, and foreign matter in mechanical systems.

Protection against radiation exposure complicates all service and maintenance practices. However, many new techniques and special tools (Table I) are being developed to assist in maintenance work where radioactive materials are encountered. Experience has shown that with proper shielding no protective clothing is needed by personnel working "outside" the shield even with the plant operating at 100% power. Also, unless the area within the shield has been contaminated by a coolant leak, maintenance work can be done safely after shutdown without elaborate protective clothing.

Obviously, if the coolant system is to be opened, precautions against contamination must be taken. A workman entering the shielded area during a shutdown should wear shoe covers and coveralls that can be removed and collected as he leaves. This reduces the possibility of minute quantities of radioactive material being transferred to critical areas such as cafeterias, office spaces, and other locations where it is important to have essentially no contamination.

For routine maintenance items, the schedule shown in Table II outlines estimated manhours required in a nuclear power plant designed to produce 40 to 60 Mw of heat. Standard equipment associated with the primary plant such as switchgear, valves, and circulating pumps are included as a group under the heading "standard equipment." In general, the apparatus listed is peculiar to the nuclear plant. Provisions for secondary steam plant maintenance are not included.

Data given do not include such service personnel as industrial hygiene technicians, test engineers, clerical help, janitors, etc. Only personnel actually performing a maintenance task or supervising the work are included. Based on this data approximately 60,000 manhours per year would be required for primary plant maintenance.

This may be considerably in excess of the maintenance manhours required for the heat producing portion of a conventional steam plant. But for the next several years, the nuclear power plant will still be in the early stages of development. As experience is gained, service and maintenance time may be reduced materially.

No attempt has been made to outline requirements for a maintenance crew as too many variables exist that determine the basis on which the crew is organized. Some of the influencing factors would be use of outside maintenance contractors, use of operating personnel for maintenance work, and union agreements covering maintenance work.

Preventive maintenance should, of course, be conducted according to a well-organized schedule to minimize the possibility of failure during operation. Certain components and auxiliary systems can be taken out of service for maintenance during operation if the plant operators have an opportunity to anticipate the situation and make appropriate adjustments. Practically all automatic and remotely controlled features of the plant can be transferred to manual control, thus allowing maintenance work to be performed on the bypassed units.

Extensive use should be made of operating logs and trouble reports to predict non-routine maintenance and repair work. For example, reports of slow response on hydraulically operated components may indicate partially plugged strainers or filters or possibly a malfunctioning pilot valve. Certain abnormal conditions in the primary loop can often be detected by secondary indications or abnormal conditions in auxiliary systems.

Other adverse conditions such as

Table I—Special Tools for Repair and Maintenance in a Nuclear Power Plant

Mechanical
- Seal weld cutting machines
- Automatic welding machines
- Torque wrenches
- Bolt heaters
- Weld inspection material
  - Dye checking apparatus
  - Gamma source and radiographic material
- Leak testing equipment
- Special valve tools
- Air driven hand grinders with large assortment of wheels and burrs
- Stress relieving equipment
- Industrial stethoscopes
- Boroscopes

Electrical and Nuclear
- Industrial analyzer
- Vacuum tube voltmeters
- Oscilloscopes
- Multi-channel "Sanborn" recorder
- "Brush" recorders
- Neutron source
- Gamma source
- Multiscaler

Instrumentation
- Temperature device equipment
  - Oil bath
  - Oven
- Manometers
- Dead weight tester
- Test standard thermometers
- Test standard pressure gauges

Table II—Typical Maintenance Manhour Requirements for Pressurized Water Nuclear Power Plant

System or Component (Peculiar to a nuclear power plant)	Time in manhours for routine service and maintenance (Refueling operation and steam plant not included) Based on 24 hr per day, 7 day per week operation						Remarks
	Daily	Weekly	Monthly	3 Mo	6 Mo	Yearly	
Canned motor pumps	.....	.....	1	.....	.....	.....	Per pump—megger readings
Positive displacement type pumps	.....	.....	.....	.....	8	.....	Per pump—packing and routine maintenance
Cylinder operated valves	.....	.....	.....	.....	.....	100	Valves are generally welded completely, and no routine maintenance is required. Based on 4 to 6 yrs average valve life, 100 manhours per valve per yr is allowed for replacement.
Solenoid operated valves	.....	.....	.....	.....	.....	60	For mechanical maintenance, note above applies, however, 50 manhours per vulve is allowed for replacement and 10 manhours for electrical work
Manual operated valves	.....	.....	.....	20	.....	.....	Twenty manhours per valve per quarter is a weighted average. Some valves require no attention for periods over one year. Others require repacking, replacement, etc.
Relief valves	.....	.....	2	.....	.....	.....	Testing, calibration, etc.
Filters and strainers	.....	.....	.....	.....	.....	100	No routine maintenance is performed on strainers and filters in as much as back-flushing is intended to keep the units in operating condition indefinitely. However it may be necessary occasionally to replace or repair these units
Demineralizers	.....	.....	.....	.....	48	.....	Per unit—recharging
Reactor control system	8	16	100	.....	500	1,000	Routine maintenance and calibration
Auxiliary control and instrumentation	8	16	200	.....	1,500	2,000	Routine maintenance and calibration
Control rod drive mechanism	.....	.....	.....	.....	.....	500	Normally no maintenance is required between shutdowns; however, 500 manhours per yr is included as a contingency for operational errors or other unforeseen incidents which may damage these units
Temperature monitoring system	.....	.....	32	.....	.....	.....	Routine maintenance and calibration
Rod-motor-generator sets	.....	.....	2	.....	.....	.....	Per set—routine maintenance
Pressure transmitters and differential pressure cells	.....	.....	.....	4	.....	.....	Per unit—No routine maintenance is required; however alignment is occasionally required. Mechanical failures are almost entirely limited to damage due to operational errors
Valve position indicators	.....	.....	.....	.....	.....	4	Per unit—calibration
Immersion heaters	.....	8	.....	.....	.....	.....	Per bank—megger readings, and replacement
Radiation monitoring system	.....	8	.....	.....	.....	.....	Routine maintenance and calibration
Thermostats and thermocouples	.....	.....	48	.....	.....	.....	Adjustment and replacement
Pressure gauges	.....	.....	.....	.....	.....	2	Per gauge—check calibration
Pressure switches	.....	.....	.....	.....	.....	2	Per switch—check calibration
Standard equipment	.....	.....	.....	.....	.....	9,000	.....
Cleaning, painting, etc.	32	.....	.....	.....	.....	.....	.....

excessive pure water leakage can be detected by increased level in leak collecting flasks or increased charging requirements. Remote viewing devices permit visual inspection of primary apparatus within the sheild. Defects such as loose equipment, discolored lagging or cable, water or steam leakage may be observed while the plant is operating.

Many preventive maintenance practices already well known in conventional plants are also applicable to nuclear power plants. Cleanliness and good housekeeping are of utmost importance. An adequate preventive maintenance program for mechanical equipment will, among other consid-

erations, include prevention of leaks, general equipment cleanliness, proper lubrication, and proper adjustment or calibration of apparatus.

For electrical equipment, the program will include general equipment cleanliness, proper adjustment and calibration of apparatus, and a high degree of insulation resistance. Nuclear instrumentation components, in particular, require very high insulation resistance; up to 10^{13} ohms.

Before any component is taken out of service for maintenance, a previously prepared procedure should be available to insure that associated systems and components are not adversely affected. This procedure must provide the workman with sufficient detail to enable him to perform his assignment on the item involved as well as prevent him from causing trouble in other areas. For example, such a simple task as an electrician replacing a damaged switch can "scram" the reactor and shut down the plant if proper jumpers are not installed.

Workmen entering the shielded area for repair tasks must be adequately protected. Prior to entering the area, a survey should be made to determine the degree of airborne contamination. With the reactor shut down, unless a coolant leak has been experienced, the area will ordinarily be found safe for working without gloves or respirators. Even after a nominal primary system leak the ventilation system will generally clear the atmosphere by the time the plant has been cooled and workmen are ready to make repairs. Thus, generally speaking, no hoods or respirators will be needed when entering the shielded area with the reactor shut down.

External contamination from coolant leaks generally may be cleaned up by several wipings with clean dry cloths. In areas where extensive leakage or high level contamination has been experienced, it may be necessary to employ a rotational method of sending workmen into the area to clean up the contaminants. In some cases, temporary shields may be necessary in localized area to reduce the ambient radioactivity level.

Should repairs to the primary system require the removal of a component from the sealed system, a cutting or grinding operation is necessary. Care should be taken to contain the metal chips within the working area so they may be easily removed. The work area should be monitored intermittently or constantly depending upon prevailing circumstances. If the component or apparatus being removed has been drained of primary water, it is likely that radioactivity has decayed to a safe level by the time piping and mountings are disassembled so that the piece in question can be removed.

The worst problem of contamination is usually encountered when it becomes necessary to disassemble a component that has been in the system for a considerable period and has accumulated various radioactive corrosion products within its closely fitting parts or recesses. In this case, every precaution for personnel safety must be exercised. The industrial hygiene group should supervise each step of the disassembly procedure.

Calder Hall: Birth of New Technology (*Continued from page* 18)

can be carried out. These operations are done by machines which run on rail tracks laid in the concrete above the reactor vessel. These machines use manually operated grabs. The operator is fully protected against radiation. It takes 1¼ hr to discharge and charge a group of four fuel element channels.

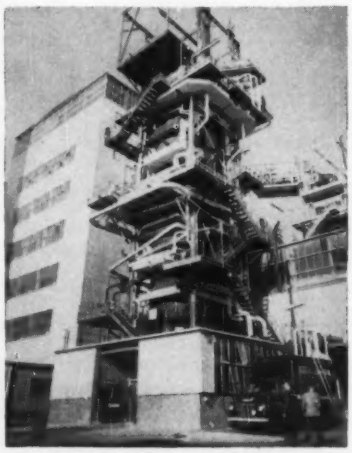
The fuel elements in each reactor contain a total of about 63 tons of natural uranium. Each rod is 40 in. long and 1.15 in. diam It is canned in magnesium alloy.

The fission rate in the pile is controlled by the vertically moving control rods which travel over the full 21-ft depth of the reactor core. Coarse and fine control is provided. Coarse control rods operate at speeds of 50, 5, and 0.5 in. per min. The fine operation control has a maximum speed of 50 in. per min.

Generated heat is removed by a 7.1-million lb/hr flow of carbon dioxide gas, driven through 4.5-ft-diam ducts by four centrifugal blowers. Inlet temperature is 284F and the outlet temperature is 668F.

Heat exchangers consist of steel vessels about 80 ft high and 18 ft in diam. They are made of 1⅝-in. steel.

Fuel element temperature limited steam conditions to 590F at 200 psia and 340F at 53 psia. The heat exchanger vessels therefore included boiler and superheater elements for both high pressure and low pressure systems. Total area of heat transfer exposed to "live" gas is 99,985 sq ft.



THIS GIANT HEAT EXCHANGER dwarfs the truck at Calder Hall's A-plant site

High pressure steam forms 77% of the total, and reaches 198,000 lb/hr while low pressure steam, providing 23%, equals 59,300 lb/hr.

The steam equipment includes one unusual feature—the dump condensers. These are provided so reactor steam can be disposed of if the electrical loading on the turbine should be removed suddenly. Calder A has a dump condenser for each reactor, one at each end of the turbine building. Each can handle the steam load for two turbines, equalling 514,600 lb/hr.

Calder Hall's output is estimated to cost 6.9 mills per kwhr, allowing for plutonium recovered from spent fuel elements. If the fuel elements could be used fully, irrespective of plutonium production, the cost would run about 1.15¢ per kwhr—still commercially competitive in Great Britain. Fuel element life is estimated at 3,000 megawatt days per ton.

Calder Hall A now takes its place as a normal power station for continuous supply of energy up to about 65 Mw, and by the first quarter of next year about 92 Mw should be available for public supply.

If you flew into Ft. Worth tonight...

Your landing would be lighted with power from the world's

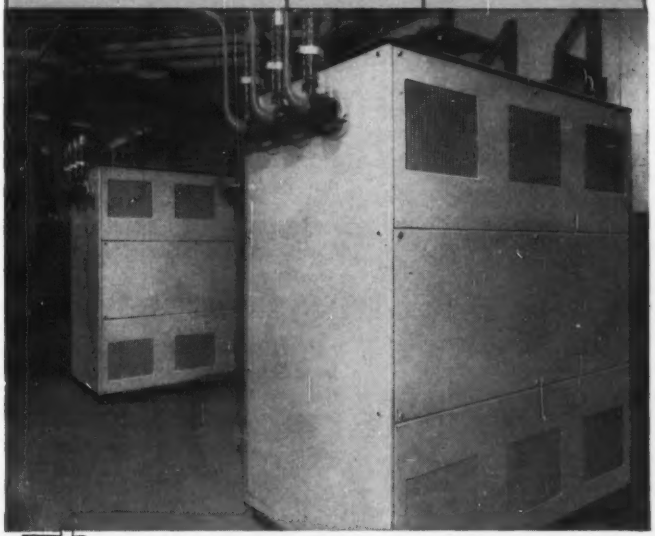
SAFEST DRY-TYPE TRANSFORMERS

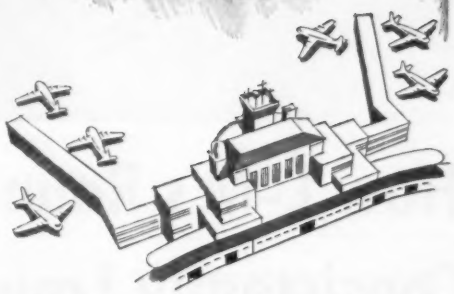
PENNSYLVANIA
Silicone-Insulated
TRANSFORMERS

at Greater Ft. Worth International Airport

are 1000-kva ventilated units, three phase, 60 cycles, 150 C. rise, 12470Y — 480Δ volts. Silicone-Insulated Transformers (formerly known as "Class H", now NEMA Group 3) were pioneered by Pennsylvania. The following types and sizes now are available:

TYPE	KVA	VOLTAGE
Ventilated	Up to 3000	Up to 15 kv
Sealed-in Nitrogen	Up to 2000	Up to 15 kv





Power from two of the world's safest transformers — Pennsylvania *Silicone-Insulated* 150 C. Rise Transformers — would continue to light your way even after you stepped from the plane and entered the terminal building at Greater Ft. Worth International Airport. These two 1000-kva dry-type units are ideally suited for indoor installation because there is *no fire or explosion hazard* as with oil-filled transformers . . . *no risk from toxic fumes as* with Askarel units.

Also important, from the standpoint of public safety, is silicone insulation's *outstanding resistance to moisture* and other potential contaminants — one of the principal reasons for the trouble-free operating records of scores of Pennsylvania Silicone-Insulated units in service throughout the country. Such dependability — plus an *exceptional overload capacity* that can be called on in case of emergency — is of vital importance for the field and terminal lighting system at busy Ft. Worth International Airport.

PENNSYLVANIA TRANSFORMER COMPANY
A McGraw Electric Company Division **CANONSBURG, PA.** *Greater Pittsburgh District*

L-M transformers provide balanced performance which results in low losses. Extremely quiet operation is another advantage. L-M's new obround tank design, shown here, retains all outstanding Round-Wound performance characteristics.

How L-M's Round-Wound® Design Assures Consistently Low Losses, Greater Revenue

L-M's wound-core, round-coil construction provides the most efficient design for low losses, good regulation, greater revenue at all power factors.

By **R. W. HARTSOOK**
Chief Engineer
Small Distribution
Transformers
Line Material Company

One of the most important objectives in transformer design is to achieve a balance of low copper loss, low exciting current, and low core loss without sacrificing other desirable performance characteristics. The Round-Wound design has many inherent advantages that aid the designer in achieving this objective.

Round-Wound Design Offers Balanced Performance

L-M's Round-Wound transformer design consists of a wound core, with a cruciform cross section closely approximating a round form. Long round coils are wound directly onto the wound core. This construction gives L-M transformers inherent advantages to minimize losses and offer balanced performance.

Low Copper Loss

In the Round-Wound transformer, the core cross section is nearly round. As shown in Figure 4 at right, a round core has a much smaller perimeter than a rectangular core of the same cross-sectional area. Therefore the turns in a Round-Wound coil are shorter. (Figs. 2 and 3). With the same cross-section wire and the same number of turns, there is less total length of wire and less watts of copper loss.

In addition, the higher efficiency of the core-coil arrangement actually permits fewer turns. The combination of smaller turn diameters and fewer turns results in low reactance and impedance, giving the desirable regulation indicated by the curves in Figure 1.

High Overload Capacity

Low copper loss also contributes to better overload capacity, since copper loss watts increase as the square of the overload on a transformer. Therefore any reduction in copper loss results in a substantial increase in overload capacity. This is a bonus over the excellent overload capacity of the Round-Wound transformer resulting from its exceptionally good cooling characteristics.

Low Exciting Current, Low Core Loss

L-M's core is tightly wound of a continuous strip of oriented steel. Coils are wound directly onto this core by means of L-M's exclusive winding machine. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux path. This construction results in low exciting current and high magnetic efficiency of the core.

Quiet Operation

L-M's wound-core construction eliminates all laps, flaps and gaps in the laminations. This contributes greatly to the extremely quiet operation of L-M's Round-Wound transformer.

Get Details on L-M's Round-Wound Transformers

Ask the L-M Field Engineer for complete information on L-M's Round-Wound design, and bulletins. Or write Line Material Company, Transformer Division, Zanesville, Ohio.

LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION

L-M's wound-core, round-coil construction provides exceptionally good cooling for high overload capacity and almost an ideal magnetic circuit to minimize losses.

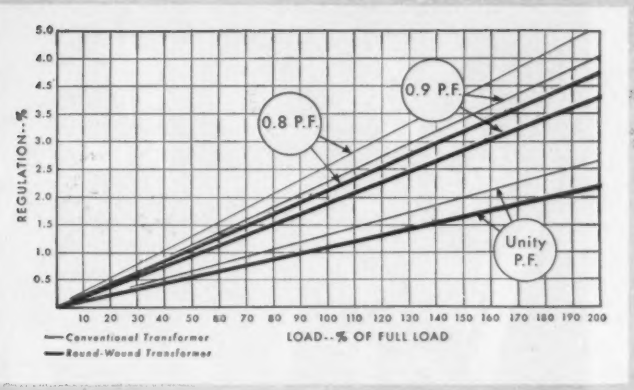


Fig. 1. Round-Wound offers good regulation at all power factors. Regulation of new 25 kva 2400-120/240 volt Round-Wound transformer compared with that of older design, showing effect of load and power factor on regulation. Multiply the difference in regulation by the number of old distribution transformers on your system, and see how much more revenue these modern L-M transformers produce.

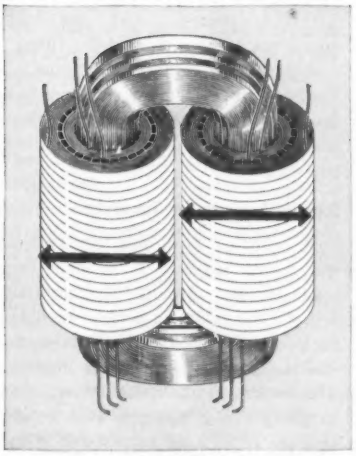


Figure 2. Round-Wound Design

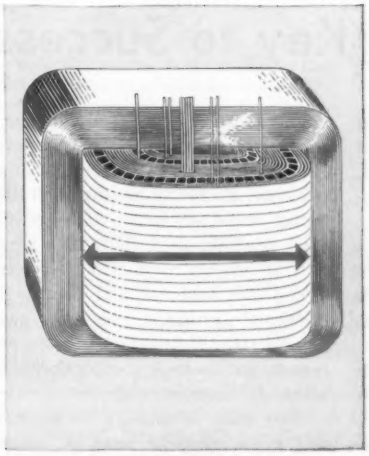


Figure 3. Shell-Type Design

Compare the difference in mean-turn diameter. L-M's Round-Wound design with the long round coils has a lower mean-turn diameter than a shell-type design. This contributes to L-M's low losses, which in turn result in good regulation, greater revenue at all power factors.

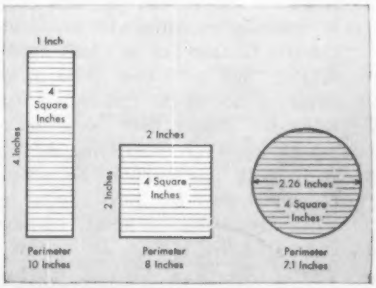


Figure 4. Compare the difference in perimeter. Each of these core cross sections has an area of 4 square inches. It takes only 7.1" of wire to make a turn around the core of round cross section typical of L-M transformers. This results in better utilization of copper, lower copper loss.

Five Reasons Why More Customers Are Selecting L-M Round-Wound Transformers

1. Higher Uniform Impulse Level: Round coils are *wound* into shape. Therefore insulation is not damaged by malleting into rectangular shape. Coils have longer creepage distance between windings and between leads.

2. Higher Short-Circuit Strength: Round coils are not stressed out of shape under high radial short-circuit forces. Strong steel frame, heavy clamping bolts, sturdy maple blocks and varnished coils prevent axial movement.

3. Higher Short-Time Overload Capacity: Round coils and the cruciform cross-section core expose large surfaces to cooling oil. The result is relatively low hot-spot temperatures, which add considerably to high short-time overload capacity.

4. Balanced Performance: The core is a continuous wound strip of oriented steel. Coils are wound directly onto this core. Since the core is not cut, unwound, or disturbed in any way after annealing, there are no air gaps to break up the flux path. This results in low exciting current and core loss.

The wound-core, round-coil design permits fewer winding turns and smaller turn diameter. This results in low impedance, and provides better regulation at all power factors.

5. Additional Capacity on Pole: L-M's new obround tank design makes the unit smaller and lighter, with shorter moment arm from the pole. This combination reduces the bending moment on the pole and crossarms, and thus greatly increases the potential capacity of existing transformer structures.

NEW OFFICERS elected at 21st conference: A. H. Kessler, left, secretary; Glen Logan, vice president; John McDermott, treasurer; and Don Rosenthal, president

IAEL Gets Reports on National Programs, hears that . . .

Grass Roots Is Key to Success

The fight for consumer attention was the big topic at International Association of Electrical Leagues' 21st conference last month at Detroit.

To get this attention leagues need to work for team work and full-scale promotion on local levels. Speakers stressed this theme while reporting on the progress of national programs (Live Better . . . Electrically, Housepower, Adequate Wiring, and National Electrical Week) which are laying the groundwork for grass roots action.

Here's how they described the need and urged U. S. and Canadian league managers to step up programs:

J. Reed Hartman, chairman of Electrical Industry Coordinating Group, said, "The continuation and expansion of these national programs are dependent upon the success which they achieve, and this success depends entirely upon what is done at the local level."

Hartman, a Cincinnati Gas & Electric Co vice president, said the league is the most effective means for local coordination. He told 115 registrants to work for the principle of industry interdependence because now "you will find an atmosphere more favorable for the development of your programs than you have ever had in the past."

Robert E. Boian, manager of Live Better . . . Electrically, described the LBE program as a national adaptation of leagues' promotional effort—selling the need for and benefits of members' products, leaving companies free to promote their own brands, and meeting competition from others for consumer dollars.

"We must constantly seek newer and more effective ways of getting attention and communicating our message," said Merrill E. Skinner, vice president, Union Electric Co and National Electrical Week committee chairman. Electrical Week "offers electrical leagues a terrific opportunity . . . to cash in on a tremendous amount of national publicity."

Skinner suggested these steps:

1. Form a representative committee.

2. Gear program to local conditions, size and location.

3. Undertake projects described in NEW's committee's kit.

4. Use imagination.

National Adequate Wiring Bureau and leagues have the same aim— coordination, said C. T. Bremicker, sales vice president, Northern States Power Co, and chairman of the bureau. By tying in with Edison Electric Institute's Housepower program, a 1957 plan of action insures that "those who will be asked to put adequate wiring promotional programs into effect at the local level will have no questions in their minds as to which direction they should take, in order to tie in with national campaigns."

NAWB has developed a new kit of promotional tools, designed for use by electrical contractors, Bremicker said. In the year ahead a specific national activity in commercial-institutional adequate wiring will begin.

As for Housepower, since its May introduction this is what has happened on the national scene, as reported by Milton I. Allen, Philadelphia Electric Co's vice president of sales:

- Gained an identification recognition of 19.9% in U. S.
- Nearly 300,000 entries in the $100,000 contest. And, for every entry, ten persons studied the rules.
- For every dollar of national advertising by EEI, about $3 has been invested by manufacturers. And local utility backing has exceeded national support.

Small Dealers in Trouble

A warning note was sounded by Ver Lynn Sprague, a regional sales manager for Amana Refrigeration, Inc. "Dealers are in serious trouble," he said. The reason: U. S. is now a nation filled with "sharp buyers." Thousands of small dealers are close to going broke, Sprague said, mainly because of lack of knowledge. Dealers need help on business management, advertising, promotions, bank dealings, handling trade-ins, and training salesmen to adjust to this smart new consumer.

The electrical industry hasn't even scratched the surface yet, said Roy W. Johnson, executive vice president, General Electric Co, in a look at the future. "We have been thinking in terms of adding to residential load when we should have been thinking in terms of multiplying it," he said. With this outlook, he added, residential goal for 1965 should be a half-trillion kilowatt hours. Johnson also urged that leagues get into ACTION (American Council to Improve Our Neighborhoods).

ADVERTISEMENT

Highlights in development of pvc compounds for wire and cable

1932. Experimental work began.

1935. First commercial production, principally for signal and instrument wiring.

1938. Underwriters' approval in appliance lead wires.

1930-40. Underwriters' approval as Type T wire for rewiring jobs.

WORLD WAR II YEARS. Military applications: communications, power, electronics, signalling and others (including aircraft and shipboard);

Code recognition for use as Type T wire for new installations;

Underwriters' approval (1943) and NEC recognition as Type TW for wiring in wet locations.

1946-48. New applications and approvals: machine tool wiring, switchboard wiring, street lighting cable, cords, control cable, and many others.

1951. Acceptance by IMSA for police and fire alarm cable NEC recognition as TW wire through 2000 MCM; Underwriters' approval of Rome Synthinol 901 for 105°C. appliance wiring and, in

1954, approximately 100 million pounds of polyvinyl chloride compounds were used by the wire and cable industry.

CURRENT TRENDS

No. 4 in a series of articles

Progress report on polyvinyl chloride insulations

Since 1932, when researchers started investigating polyvinyl chloride compounds for wire and cable, it has become one of the most popular insulating materials available. In fact, over 100 million pounds were used by the wire and cable industry in 1954 alone!

To bring you up to date on polyvinyl chloride wire coatings and Rome Cable's product—Rome Synthinol® in particular, is the purpose of this brief report.

What are polyvinyl chloride compounds?

These compounds consist of polyvinyl chloride (or a co-polymer of polyvinyl chloride and polyvinyl acetate) thermoplastic resin mixed with plasticizers for flexibility, fillers for strength, pigments for color, and stabilizers for resistance to age and oxidation. The combined properties of these ingredients determine the properties of the compound. The compounds are thermoplastic in that they do not require vulcanization. They are generally applied to wire by the extrusion process.

Polyvinyl chloride compounds produced by Rome Cable bear the registered trade name Rome Synthinol®.

Characteristics of Rome Synthinol

Rome Synthinol has earned its popularity because of these desirable characteristics:

Economy—low in cost; and because of its small diameters, handling and installation costs are minimized

Simplicity—no outer braids required

Flame Resistance—inherently resists burning

High Dielectric Strength—higher than most rubber compounds

Moisture Resistance—superior to many rubber compounds

Appearance—bright, shiny colors

Weather Resistance—unaffected by long exposure to sunlight and weather

Versatility—suited to many low-voltage insulation and jacket applications—indoors or out, in conduit or duct, in water, or in the ground

Special compounds

Because polyvinyl chloride insulation and jackets derive their properties from the materials they contain, it is possible—through proper ingredient selection—to "engineer" compounds for specific end uses. Here are some of the special applications:

Cold—special compounds are available for low-temperature applications—down to 40°C. and lower

Heat—special compounds are available for high-ambient conditions—up to 105°C.

Deformation—special compounds, or special cable design, can reduce this effect

Moisture—most polyvinyl chloride compounds have very good moisture resistance. But careful selection is advised if dc potentials are involved in wet locations.

Polyvinyl chloride insulation should not be used where heavy and/or frequent current overloads are involved (such as in network cable). And because of relatively higher dielectric losses, it is not generally recommended for the higher primary distribution voltages.

Specifications

The various polyvinyl chloride wire and cable industry specifications in use today are: Underwriters' Specifications; ASTM D734; IPCEA Appendix I for insulation, Appendix J for sheath; Federal Specification JC-129; IMSA Specification No. 20.

There are also, of course, many individual customer specifications applicable for specific end uses.

Typical applications

Rome Synthinol and other polyvinyl chloride materials are suited for these wire and cable applications:

Type TW building wire
Nonmetallic sheathed cable
Type UF underground feeder cable
Machine tool wire
Station control cable
Series street lighting cable
Multiple street lighting cable
Multiple conductor instrument wiring
Fire alarm and traffic signal cable
Over-all jackets
Fixture wires
Radio hook-up wire
Appliance wires

Further developments

From its active and pioneering part in the development of polyvinyl chloride compounds, Rome Cable's experience is reflected in Rome Synthinol Cables. Special Rome Synthinol Compounds are available for many unusual applications.

A notable example is Rome Synthinol 901, the first high-temperature polyvinyl compound to receive appliance wire listing for 105°C., and later approved for use on TW moisture-resistant building wire. Because of other outstanding properties—increased resistance to oils, solvents, and chemicals—Synthinol 901 has proved itself as a preferred insulation material for chemical, petroleum, and other industrial wiring where high temperatures and environmental hazards are a continuous problem.

If you have a wire and cable problem for which a polyvinyl chloride compound might provide the answer, our experience is at your service.

ROME CABLE CORPORATION, Rome, New York

Ross Heads Indiana Electric Association

P. W. Ross, vice president and assistant to the president, Indianapolis Power & Light Co, was elected president of the Indiana Electric Association at its 47th annual convention meeting Oct. 3-5 in French Lick, Ind.

The convention program featured a variety of speakers on subjects of general industry interest.

Donald S. Kennedy, president of both the Edison Electric Institute and Oklahoma Gas & Electric Co, urged Association members to help explain the "preference clause" to the public. The clause, found in varying forms in federal statutes, gives priority to public bodies and co-operatives in the purchase of federally-produced power. Kennedy told the convention:

"The one great principle to which all Americans have rallied and around which they must rally in the future is that everyone is equal before the law. This means not only that one individual will not be relieved arbitrarily of any burden imposed by law upon everyone, but that in protection under the law and in regard to benefits and services from the government, no individual will be preferred above others. Fair and equal treatment carries no party label. It should need no partisan emphasis, and every member of any American political party should demand that preferential treatment and preferences should be eliminated."

To fully carry the story to the country, Kennedy said, "takes teamwork within and publicity outside the industry."

Dr. Nicholas Nyaradi, former Hungarian Minister of Finance, told how his homeland had succumbed to the Communist menace and how he had fled to America to regain his freedom. He urged the industry to continue its fight to protect democratic rights.

On the subject, "Good Human Relations Pay Dividends," J. C. Faris, head of Union Electric Company's Customer Business Department, told his audience that selfishness is an inherent characteristic of the human race. "This must be recognized and wisely dealt with," he said. He offered these tips for dealing with customers: don't argue, be patient, use other peoples names as frequently as is necessary, take all the time necessary to say "no," and take a second to say "thank you."

J. K. Langum, president, Business Economics, Inc, forecast a generally bright economic picture. But he cautioned that recessions are a probability during the next decade, although depressions may be avoided.

PEA Systems Group Studies Load Forecasting

Load forecasting, service interruptions, and training methods were the main topics discussed at the fall meeting of the Pennsylvania Electric Association Systems Operation Committee held at Altoona, Pa., Oct. 10 and 11.

A new approach to forecasting daily peak loads, predicting level of illumination, was described by D. K. Gillies, Hydro-Electric Power Commission of Ontario. In describing the system, he indicated that season of the year, cloud type and height, visibility, and degree of precipitation are factors that determine the level of illumination.

A study of weather conditions, level of illumination, and actual peak loads produced information from which it was possible to predict how illumination should differ from a normal day (described as a cloudless sunny day) under forecasted weather conditions. This information has been prepared in chart form for the various months of the year. A correction for temperature has also been made.

Machine tabulation of service interruptions has proved valuable to West Penn Power Co., according to W. G. Bryner. Benefits include:

1. Better information to answer customer complaints.
2. Accumulation of information to help give better service to all customers.
3. Elimination of interruption-prone lines.
4. A means to compare different methods of substation design and construction.
5. Simplification of preparing annual reports on outages.

Punch-card accounting of interruptions under seven major classifications is kept. Some of the classifications are purpose or event, equipment failure, voltage level, nature of fault, and prevailing weather conditions. The system is set up to gather, record, and analyze information about interruptions in relation to stations, buses, or equipment not number of customers interrupted.

There were two papers on training. In the first W. C. Bryson, Duquesne Light Co. said that the success of a Dispatcher's Training Program depends heavily upon initial planning. The goal of such a program must not only be to teach trainees the techniques of system operation but also to instill confidence in the man so that he will be capable of the original thinking required of a dispatcher in emergency situations. A training program founded on these principles has proven successful for the Duquesne Light. This program is divided into four parts; namely:

1. Orientation.
2. Basic training.
3. Technical training.
4. On-the-job training.

A company-made training board has been useful in training operators according to W. H. Wells, Connecticut Light & Power Co. The board and a remote operating console permit trainees to switch lines as would be done at a typical distribution substation. Represented are incoming HV lines, oil circuit breaker control switches, metering, step-down transformers, and distribution feeders. Line faults, single-phase operation, and synchronizing problems can be simulated by the mock-up. Nearly 200 men have been trained.

L-M's modern 1957 fluorescent luminaire is styled for handsome appearance, correct light distribution, and a lifetime of efficient, economical operation. It is the only fluorescent luminaire designed to take both present and future very high output fluorescent lamps.

Line Material Announces New, Advanced 1957-Style Fluorescent Luminaires

L-M's new fluorescent luminaires offer an exciting new look in street lighting equipment. The units provide more comfortable visibility, and greatly increase the scope of vision for both motorists and pedestrians.

L-M's new luminaires are the only units available today that are designed to take both present and future VHO (very high output) fluorescent lamps.

The new luminaires have a long, slim modern look, and retain all the outstanding performance characteristics of L-M's original design. Their broad, cool, white light source provides virtually glareless illumination —the ultimate goal in lighting.

L-M's modern fluorescent luminaire distributes the light over a broad area, giving good balance between building and road surfaces.

These new street lighting luminaires are available in deep and shallow styles, in both four- and six-foot lengths. For other outdoor lighting applications, such as parking lots, store front lighting, etc., other styles are available.

Get Complete Information

Get details of L-M's new 1957-style fluorescent luminaires. L-M Street Lighting Engineers will cooperate with you in designing the best lighting system for your area. Ask your L-M Field Engineer or Street Lighting Engineer for more complete information. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

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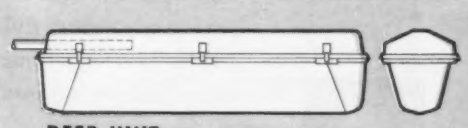
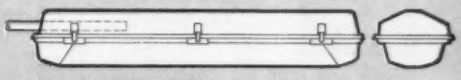


DEEP UNIT



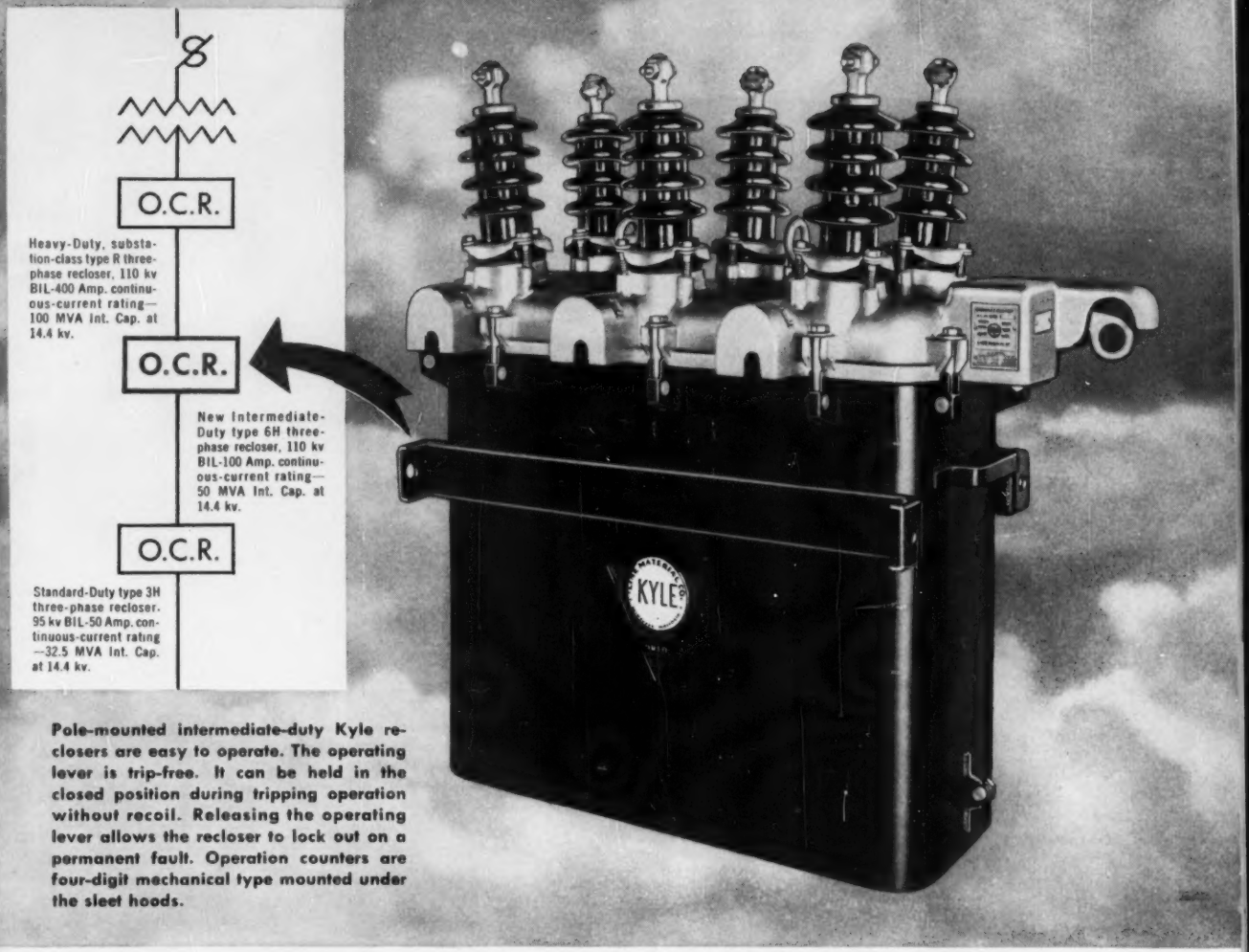
SHALLOW UNIT

Deep and shallow units are available in both four- and six-foot lengths. L-M's new fluorescent luminaires provide excellent light distribution for all applications.

LM

LINE MATERIAL Street Lighting

A McGRAW ELECTRIC COMPANY DIVISION


O.C.R.
Heavy-Duty, substation-class type R three-phase recloser, 110 kv BIL-400 Amp. continuous-current rating—100 MVA Int. Cap. at 14.4 kv.
O.C.R.
New Intermediate-Duty type 6H three-phase recloser, 110 kv BIL-100 Amp. continuous-current rating—50 MVA Int. Cap. at 14.4 kv.
O.C.R.
Standard-Duty type 3H three-phase recloser. 95 kv BIL-50 Amp. continuous-current rating—32.5 MVA Int. Cap. at 14.4 kv.
KYLE

Pole-mounted intermediate-duty Kyle reclosers are easy to operate. The operating lever is trip-free. It can be held in the closed position during tripping operation without recoil. Releasing the operating lever allows the recloser to lock out on a permanent fault. Operation counters are four-digit mechanical type mounted under the sleet hoods.

L-M Announces New Intermediate-Duty Kyle® Reclosers For Overcurrent Protection

New type 6H 3-phase reclosers incorporate all outstanding features of L-M's high-speed Kyle reclosers; available in 5 to 100 ampere ratings, 2.4 to 14.4 kv; symmetrical interrupting ratings to 3000 amps. Type 4H single-phase, intermediate-duty reclosers also available.

By **WILLIAM J. WEINFURT**
Chief Engineer
Kyle Products
Line Material Company

L-M's new type 4H single-phase and type 6H three-phase reclosers are self-contained, intermediate-duty units, designed to segregate permanent faults, and to clear transient or non-persistent faults on urban and rural distribution systems. They provide high-speed circuit clearing in less than 2 cycles with symmetrical RMS interrupting ratings up to 3000 amps. 4.8 kv and below, and 2000 amps. 14.4 kv.

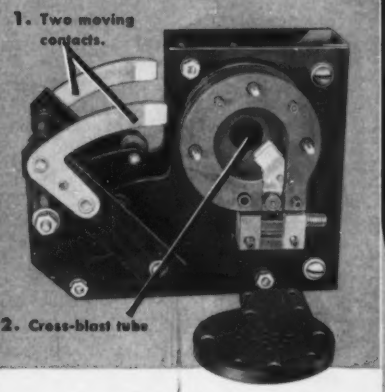
Retain Kyle Design

All the outstanding features of L-M's Kyle reclosers are incorporated in these new intermediate-duty reclosers. The timing mechanism is the service-proved Kyle hydraulic system with a selection of three time-current characteristics: Fast (A), Retarded (B), and Extra Retarded (C). Sequences can be easily adjusted for 2, 3, or 4 operations to lockout in any combination of operations. The type 6H provides single-phase tripping with operation counter for each phase, but lockout of one phase causes simultaneous lockout of all phases.

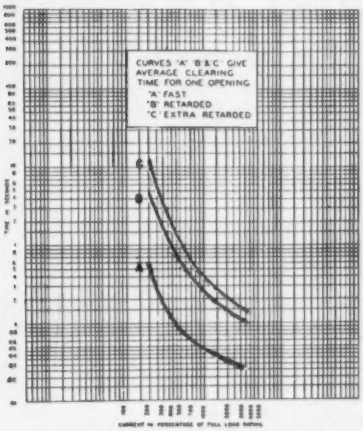
Contact Structure

Contacts and arc interrupter structure utilize the snap toggle contact action and cross-blast arc extinction principle. The cross-blast consists of two arcs drawn in series as the contacts part. Pressure

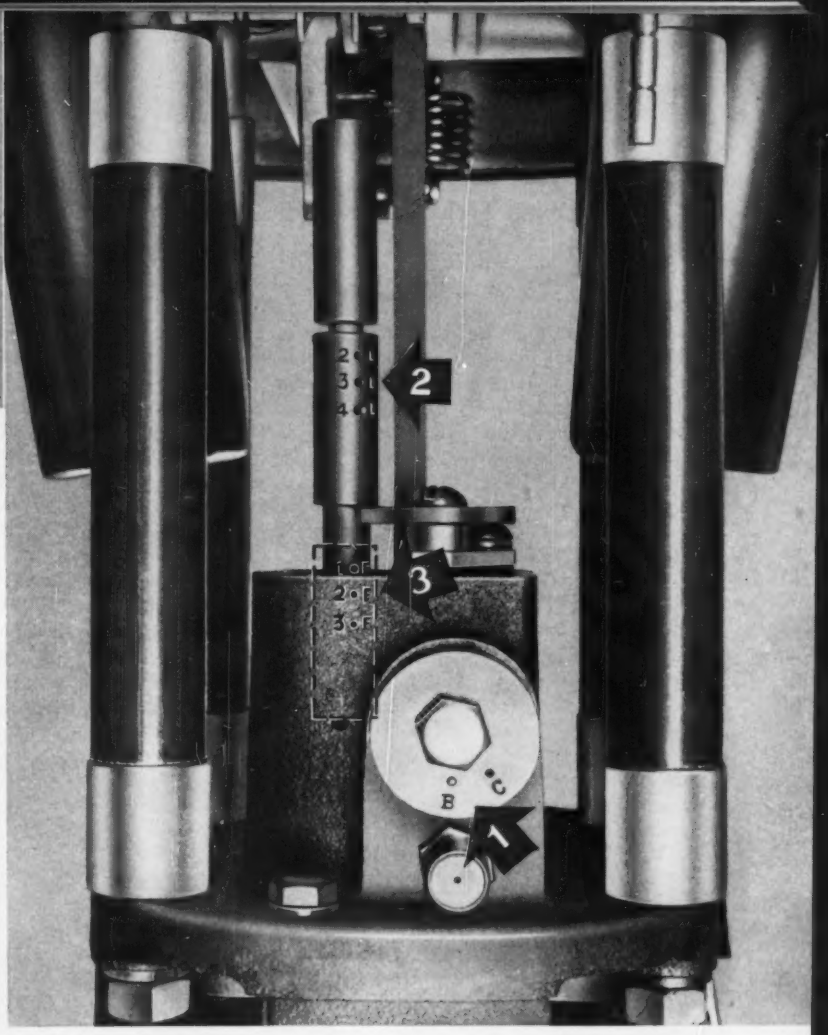
LINE MATERIAL
A McGRAW ELECTRIC COMPANY DIVISION



The new intermediate-duty reclosers utilize the service-proved cross-blast arc extinction principle. Two arcs in series are drawn as the contacts part **(1)**. Pressure generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Note the long double-break **(2)** and cross-blast tube connecting the two interrupting chambers.



Time-Current Curves for series overcurrent tripping of L-M's intermediate-duty Kyle reclosers. Each phase of the type 6H trips individually until the final pre-selected operation, when all three phases lock open simultaneously.



Time-current characteristics and operating sequences can be easily adjusted in the field. Photo shows the hydraulic system of the type 6H recloser. Time-current characteristic is selected by moving disc to curve "B" or "C" **(1)**. Number of operations to lockout is selected by adjusting vertical extension of lockout piston **(2)**. Adjustment of sequences (number of fast and delayed operations) is obtained by the proper positioning of the roll pin located at **(3)**.

generated by one arc forces oil into the path of the other arc, cooling it and extinguishing it rapidly. Arcing time over the range of fault current ratings averages less than one-half cycle.

Moving contacts are silver-plated copper tungsten to reduce pitting and assure long life to the arcing surface. In operation, the moving contact wipes into the stationary contacts, thus insuring a cool, low-resistance, load-carrying contact. In addition, all current-carrying parts of the contacts are silver-plated.

External Construction

Terminals are universal plated type and will accommodate either copper or aluminum from No. 6 solid through 250 MCM stranded in either a vertical or horizontal position.

Bushings are wet-process, 15 kv porcelain, externally clamped to head. Bushings have approximately 12″ creepage distance. The recloser will also be available with 15″ creepage-distance bushings where desired.

Get The Whole Story On L-M's Kyle Reclosers and Sectionalizers

L-M offers the most complete line of reclosers—single- and three-phase—from substation to load. Ask your L-M Field Engineer for information and bulletins on Kyle apparatus and complete coordination. Or write Line Material Company, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

Kyle type 6H 3-phase reclosers available in normal load ratings FROM 5 TO 100 AMPERES*

Ratings Amps.	Min. Trip Amps.	Inter. Ratings RMS Amperes 2.4-4.8 kv	Inter. Ratings RMS Amperes 14.4 kv
5	10	200	200
10	20	400	400
15	30	600	600
25	50	1000	1000
35	70	1400	1400
50	100	2000	2000
70	140	3000#	2000
100	200	3000#	2000

*Insulation Level: 110 kv BIL.
#2,500 RMS amperes maximum Inter. rating at 8.32 kv.

Kyle® Reclosers

What Makes an Electric Company Click?

Pioneering study at Kansas P&L aims at uncovering factors which contribute to job satisfaction and to the ability of employees to work together toward a common goal of service

A two-man research team from the Menninger Foundation for psychiatric treatment, education, and research is undertaking a pioneering assignment at Kansas Power & Light Co.

Headed by Dr. Harry Levinson, director of the Foundation's division of industrial mental health, the team is out to find what forces and factors contribute to people's well being at work. The project is financed by a $105,000 grant from the Rockefeller Brothers Fund.

But instead of approaching their study from an individual basis, these trained researchers are seeking to develop methods for obtaining some kind of composite view of the human relations in an entire business organization. In explaining the project to Kansas P&L employees, Levinson posed these questions for his study:

What has made for joint success?

What makes for your ability to work together under difficult circumstances?

What were the important factors contributing to these successful human relationships?

KP&L Chosen for Performance

Levinson chose to study the Kansas utility for a number of reasons. As he explained, the company has a long experience of expansion and growth. It is recognized for good service. Its employees face emergencies under the most difficult weather conditions and they go out and meet these demands successfully. The fact that the company is able to grow, expand, give respected service and meet extreme emergencies indicates that its employees have an ability to work together toward a common goal.

KP&L Board Chairman Dean E. Ackers, a trustee of the Menninger Foundation, has been keenly interested in the study since it first began to take shape. He has offered the full cooperation of the utility for this research, but has emphasized that the results of the study are not in any way to affect the hiring, firing, promotions, demotions, wages, hours, or the on going activities of the company.

To conduct this research, Levinson and his associate, Sociologist Charlton Price, will conduct a large number of personal interviews with members of the company from the board chairman down. They will observe people working together—how they go about their jobs, what kind of problems they tackle. In time there may be written questionnaires distributed on a broader basis.

First step in the study has been to acquaint management and employees with the objectives and methods of the project. Of necessity these have been sketched in broad outline, since the course and techniques of the research will be tailored as it goes along. Commenting on the initial response to the study, Levinson last week wrote Electrical World, "All the employees with whom we have come in contact so far have been most warm in their welcome and in learning together."

Levinson commented further:

"We feel particularly fortunate in undertaking this study at KP&L because we have the keen interest and enthusiastic support of the top management. One of the problems of social science research in industry has been that the researchers have often had little contact with management, having chiefly had the problem of how to communicate with top management. In this case we began with a direct contact with top management which we will maintain throughout."

If the study pans out, Levinson hopes he will have gained knowledge which can be usefully applied in the broad industrial field. Results of the study, he says, could contribute to science and human welfare.

Blast Launches Glen Canyon Project

This blast, triggered by President Eisenhower in Washington, toppled about 500 tons of rock into the Colorado River canyon to signal the construction start of a diversion tunnel at Glen Canyon dam, part of the $421-million Upper Colorado River project. The tunnel will carry the waters of the river through a 2,768-ft bore 45 ft in diameter while the 700-ft-high dam is under construction.

POWERS *American* PRESENTS . . .

an aerial unit designed specifically for operations requiring only one workman

THE COMPLETELY NEW

Series AB-1-41

"Sky-Master"®

HYDRAULIC AERIAL BEAM

FOR WORKING IN HARD-TO-REACH PLACES WITH GROUND-LEVEL EASE

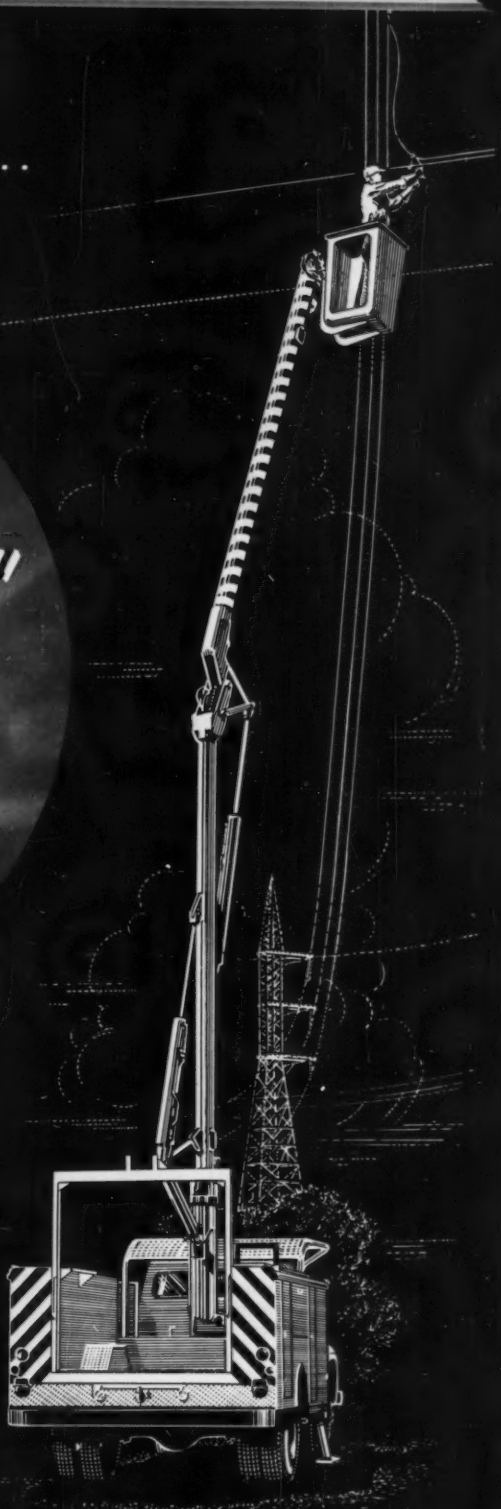
Over • under • around obstacles . . . Sky-Master quickly reaches out-of-the-way work — and provides on-the-ground safety and comfort for the workman.

Independently-operated steel beams are moved by double-acting hydraulic cylinders, through a unique system of linkage which greatly increases operating range. There are no chains, sprockets, or other secondary means of actuation. Supporting mast can be rotated *continuously* in either direction.

Work basket and insulated outer beam protects workman from 60,000 volts. Basket is automatically locked in position in event of damage to hydraulic lines.

The AB-1-41 . . . having ground-to-basket floor height of 41' . . . can be equipped for your particular job, and installed on a Powers-American Body that fits your needs.

The heavy-duty Series AB-37 and AB-43 Sky-Master carries two men up, out, over, or down. Available in 37' and 43' ground-to-basket heights.



Descriptive literature on Series AB-1 and Series AB Sky-Master — with price information — will be sent on request.

McCABE-POWERS AUTO BODY COMPANY

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KAISER WIRE

A major supplier of heavy transmission cable

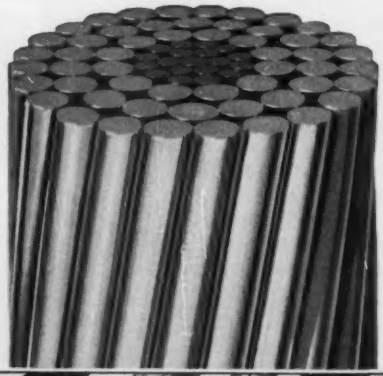
The next time you have a transmission problem, think of Kaiser Aluminum—one of the industry's major suppliers of heavy transmission cable.

For immediate attention, get in touch with your Kaiser Aluminum sales office or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., *Executive Office,* Kaiser Bldg., Oakland, Calif.; *General Sales Office,* Palmolive Bldg., Chicago 11, Ill.

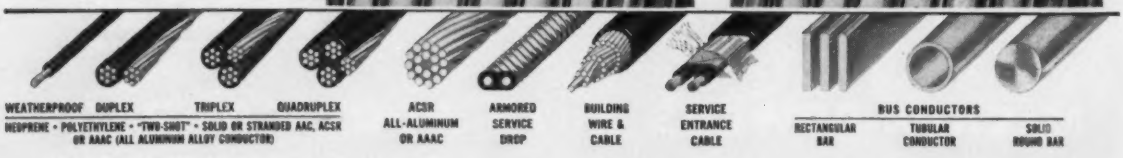
Kaiser Aluminum

Aluminum is the answer to Adequate Wiring

Kaiser Aluminum increased its sales of ACSR last year a whopping 38%!



The Industry as a whole increased sales of ACSR last year about 7%.



ARTHUR R. COX

San Diego G&E VP's Cox

Arthur R. Cox has been elected vice president and treasurer of San Diego Gas & Electric Co effective Nov. 1 with retirement of J. M. Bourus. C. W. DeVoe will replace Cox as comptroller.

A business administration graduate of the University of Texas and a veteran of 28 years' service with San Diego G&E, Cox started with the company as a clerk.

DeVoe, formerly assistant comptroller, has been with the utility 35 years.

CILCO Elevates Stone

Central Illinois Light Co has appointed Ernest W. Stone vice president and manager of its Peoria Division.

Stone, a graduate of the University of Illinois, joined CILCO in 1922 as an electric meterman and was named assistant of the electric meter department in 1928.

He was made manager of the DeKalb Division in 1951. In 1954 he became manager of the Peoria Division, a position he has held until this recent appointment.

ERNEST W. STONE

NORMAN A. COCKE

Cocke Heads A-Group

Norman A. Cocke, president of Duke Power Co, has been appointed president of the Carolinas Virginia Nuclear Power Associates, Inc.

This organization, recently formed at Charlotte, N. C., is the beginning of a plan to build an atomic reactor for the production of electric power.

Vice presidents named by the board are E. H. Will, president of Virginia Electric & Power Co; L. V. Sutton, president of Carolina Power & Light Co; and S. C. McMeekin, president of South Carolina Electric & Gas Co.

the C-E TURBO-SEPARATOR...

another reason for the high availability of turbines served by C-E Boilers

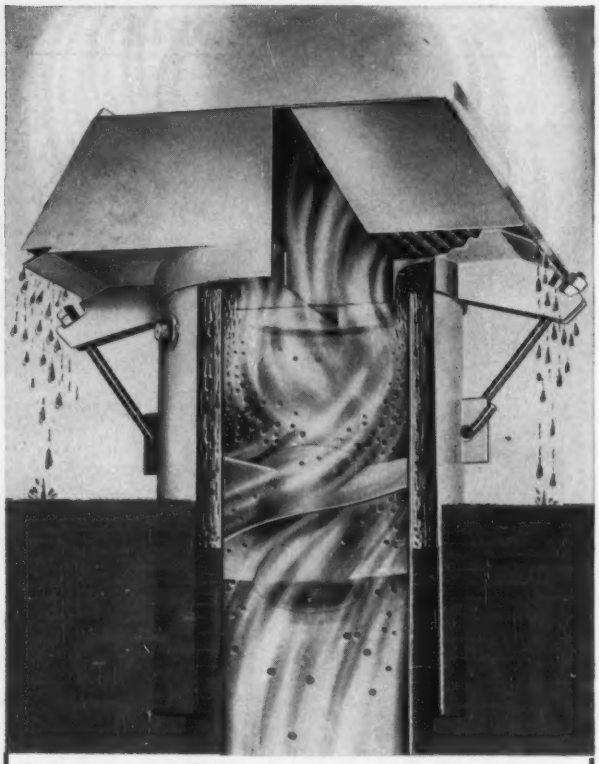
Clean steam is a most important factor in turbine performance. And clean steam demands effective drum internals.

The true test of any system of drum internals lies in what it can do with the combination of water, steam and solids it must handle — not alone under steady base load conditions — but under all operating conditions.

Whether the concentration of solids in boiler water averages less than 100 ppm or even more than 1000 ppm — or whether it fluctuates anywhere between — the C-E Turbo-Separator maintains steam purity and quality well within satisfactory limits.

To be more specific — test results in a number of cases have shown less than .5 ppm and in some instances as low as .1 ppm. These results are supported by the fact that in no plant where Turbo-Separators are installed has there been any measurable loss of turbine capacity due to deposits on turbine blades.

When you add the proven advantages of C-E Turbo-Separators to the operating characteristics of modern designs of C-E Utility Boilers, you have the right combination for top year-round plant performance on all counts — efficiency, capacity and continuity of service. B-904



HOW IT WORKS

Steam-water mixture enters the top of the boiler drum through nozzles discharging into an annular space formed by internal baffles. Flow of the mixture is directed downward behind symmetrical baffles around the entire drum surface, maintaining a uniform drum-wall temperature, and then into the Turbo-Separators which are arranged in parallel rows throughout the length of the drum. They contain a center core and vanes which give the mixture a spinning or centrifugal motion, thereby throwing the water to the outer edges of the inner tube. Directly above the directional vanes and cores there is a skim-off lip which directs the water over the top of the inner tube and thence through the annular space to the drum. This is the primary separation stage. The relatively dry steam then passes through two opposed banks of closely spaced corrugated plates, which change the direction of the steam many times and throw out much of the remaining water. This is the secondary separation stage. The third and final stage of purification is accomplished in the screen dryer.

C-E

COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

steam generating units; nuclear reactors; paper mill equipment; pulverizers; flash drying systems; pressure vessels; home heating and cooling units; domestic water heaters; soil pipe

PSE&G Appoints Hartung General Superintendent

PHILIP H. HARTUNG

Public Service Electric & Gas Co, Newark, N. J., has announced the promotion of Philip H. Hartung to general superintendent of electric generation.

Hartung, who has been assistant general superintendent of electric generation for the past 13 years, joined the company as a cadet engineer in 1923 after graduation from Lehigh University.

After being made assistant engineer at the Kearny Station, he took on several assignments in the general office and at the Essex Station. He then returned to Kearny Station to become its chief engineer in 1936.

Hartung succeeds William R. LaMotte who is retiring after more than 42 years with the utility. LaMotte, a graduate of Clemson College, has been general superintendent of electric generation since 1942 and has held various posts in the electric department since 1941.

EEI Organizational Changes

Edison Electric Institute has announced the new group chairman of its Commercial Division Committee together with sub-committees and their heads.

Commercial Sales Group—**R. I. Bull,** Ohio Power Co
- Commercial Cooking & Water Heating—**J. C. Zeiler,** Indiana & Michigan Electric Co
- Commercial Lighting—**W. P. McPherson,** Carolina Power & Light Co
- Electric Space Heating & Air Conditioning—**G. W. McElhaney,** Ohio Edison Co
- Market Development & Electrical Applications—**V. J. Ouellette,** Hartford Electric Light Co

Farm Group—**M. O. Whithed,** Atlantic City Electric Co
- Agricultural Development—**Burwell Smith,** Carolina Power & Light Co
- Farm Utilization—**E. R. Murphy,** Kentucky Utilities Co

Residential Group—**R. L. Coe,** Union Electric Co
- Dealer Coordination—**P. E. Thomas,** Rochester Gas & Electric Co
- Home Service—**Miss E. Parker,** Georgia Power Co
- Market Research—**John Sabot,** Cleveland Electric Illuminating Co
- Residential Promotion—**E. J. Hurley,** Detroit Edison Co

Industrial Power & Heating Group—**F. E. Wiatt,** Cincinnati Gas & Electric Co
- Competitive Service—**G. M. Allen,** Detroit Edison Co
- General Power & Heating—**H. W. Memmott,** Connecticut Light & Power Co
- Industrial Sales Methods & Development—**P. W. McCormick,** Union Electric Co

Special Service Group—**B. L. Palm,** Central Illinois Public Service Co
- Wiring & Specifications—**J. G. McKearin,** Western Massachusetts Electric Co

PERSONAL BRIEFS

Sixteen members of American Institute of Electrical Engineers have been elevated to the grade of Fellow. They are: **Constantine W. Bary,** Philadelphia Electric Co; **Reginald R. Benedict,** University of Wisconsin; **Charles T. Button,** Wright Machinery Co, Div. of Sperry Rand Corp; **Laurence K. Del 'Homme,** Houston Lighting & Power Co; **William J. Dowis,** General Electric Co; **George D. Floyd,** Hydro-electric Power Commission of Ontario; **Thomas D. Gordy,** GE; **William T. Hess,** Louisiana Power & Light Co; **William D. Kyle, Jr,** Kyova Fiber Pipe Co; **Edward E. Lynch,** GE; **Leon Podolsky,** Sprague Electric Co; **Ellery H. Raddin,** Champion Lamp Works; **Walter Schaelchlin,** Westinghouse Electric Corp; **Royal D. Sloan,** State College of Washington; **John Wallis,** Oklahoma Gas & Electric Co; and **Raymond R. Wisner,** Stone & Webster Engineering Corp.

General Electric Co has appointed **Charles B. Seelig** to succeed **Ralph E. Donnelly** as manager-marketing for the small steam turbine department. Donnelly transfers to the large steam turbine-generator department. . . . **Dr. John S. Saby** has been appointed manager of Lamp Research Laboratory of GE's Advanced Lamp Development Laboratory at Nela Park. . . . **Leonard W. Collins,** formerly manager of general accounting for GE's vacuum cleaner department, has been assigned the same post with metallurgical products department.

OBITUARY

Samuel G. Allen, 86, chairman of Combustion Engineering Co of New York, died at his winter home in Pinehurst, North Carolina, of a heart attack.

James M. Seay, 77, retired vice president and comptroller of Niagara Mohawk Corp, died recently.

Henry N. Muller, one of the founders of Muller, Harper & Associates, Inc, and formerly with Duquesne Light Co, died recently. He once served as president of Pennsylvania Electric Association.

Rely on Graybar . . .

ESPECIALLY IN EMERGENCIES

Graybar's long experience in serving the everyday needs of utilities is especially valuable when lines go down.

A nation-wide network of Graybar offices and warehouses provide ready accessibility of pole-line supplies. You can depend on the fastest possible deliveries of emergency replacement items —wherever and whenever they are needed.

Experienced Graybar personnel have developed the know-how needed to initiate immediate action and efficient follow-through from working closely with utilities daily and through emergencies of all kinds.

Moreover, Graybar is totally owned by its operating and retired personnel. That's why you're sure to get, especially in emergencies, *personal* service from people who have a *personal* interest in giving you the assistance you need, when you need it. 619-911

Graybar Electric Company, Inc.
420 Lexington Avenue, New York 17, N. Y.

Call Graybar first for...

IN OVER 130 PRINCIPAL CITIES

MEETINGS CALENDAR

NOVEMBER

Edison Electric Institute—Commercial Lighting Committee, Shoreham Hotel, Wash., D. C., Nov. 8-9; Residential Group Chairmen, St. Louis, Mo., Nov. 8-9; Industrial Relations Committee, EEI Headquarters, New York, N. Y., Nov. 15; Industrial Power & Heating Group, Detroit, Mich., Nov. 15-16; EEI-AGA General Accounting Committees, Henry Grady Hotel, Atlanta, Ga., Nov. 26-27; Accident Prevention Committee, Statler Hotel, Hartford, Conn., Nov. 26-28.

National Rural Electric Association—Region Nine Annual Meeting, Davenport Hotel, Spokane, Wash., Nov. 12-13.

National Electrical Manufacturers Association—Annual Meeting, Traymore Hotel, Atlantic City, New Jersey, Nov. 12-16.

Pacific Coast Electrical Association, Inc—Administrative Services Section, Hotel Biltmore, Santa Barbara, Calif., Nov. 14-15.

American Society of Refrigerating Engineers—43rd Semi-Annual Meeting, Hotel Statler, Boston, Mass., Nov. 25-28.

Inland Empire Waterways—23rd Annual Convention, Chinook Hotel, Yakima, Washington, Nov. 26-27.

American Society of Mechanical Engineers—22nd National Exposition of Power and Mechanical Engineering, Coliseum, New York, N. Y., Nov. 26-30.

Third International Automation Exposition—New York Trade Show Bldg., N. Y., Nov. 26-30.

Great Lakes Conference of Railroad and Utilities Commissioners—First Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va., Nov. 29-30.

DECEMBER

Institute of Radio Engineers—2nd Instrumentation Conference, Biltmore Hotel, Atlanta, Ga., Dec. 5-7.

Edison Electric Institute—1957 Conference Planning Committee, sponsored jointly with American Gas Association, EEI-AGA Headquarters, New York, Dec. 6-7; Street Lighting Committee, Dayton, Ohio, Dec. 6-7; Commercial Cooking & Water Heating Committee, Cleveland, Ohio, Dec. 13-14.

JANUARY, 1957

Northeastern Weed Control Conference—Sheraton-McAlpin Hotel, New York City, Jan. 10-12.

Doble Engineering Co—24th Annual Conference of Doble Clients, Sheraton-Plaza Hotel, Boston, January 14-18.

Southeastern Electric Exchange—Personal Administration Section Meeting held jointly with EEI, Sheraton-Park Hotel, Washington, D. C., Jan. 17-19.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, Jan. 21-25.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, Hotel President, Kansas City, Mo., Jan. 31-Feb. 1.

FEBRUARY

National Association of Purchasing Agents—26th Annual Mid-Winter Conference, Public Utility Buyers' Group, Brown Hotel, Louisville, Ky., February 3-5.

Electric Institute of Washington—Electrical Trade Conference & Exposition, Shoreham Hotel, Washington, D. C., February 12-14.

• **American Institute of Electrical Engineers**—1957 Transistor & Solid State Circuits Conference sponsored jointly with Institute of Radio Engineers and University of Pennsylvania, University of Pennsylvania, Philadelphia, Pa., Feb. 14-15.

Pacific Coast Electrical Association—Business Development Section, Sheraton-Palace Hotel, San Francisco, Calif., Feb. 28-Mar. 1.

American Society of Heating and Air-Conditioning Engineers—63rd Annual Meeting, Chicago, Ill., Feb. 25-28.

• Additions this week.

Work Progresses Steadily on St. Lawrence Project

Work is progressing steadily on the St. Lawrence Seaway and Power Project—the largest engineering feat ever performed on the North American continent. When finished, it will provide a deep waterway from the head of the Great Lakes to the Atlantic Ocean—a distance of 2,200 miles. About 2.2 million horsepower will be generated in the form of electric energy.

A new canal and lock, and a control dam are to be built at Iroquois, Ont., at the head of a 35-mile "power pool" between this point and Cornwall, Ont. The control dam shown here is being constructed on the United States side of the river by the New York Power Authority.

When completed, the control dam will back up water that will inundate the site of a village. But most of the residents have been moved lock, stock, and house half a mile inland to the site shown in the other picture. Nearly all the 143 houses have been brought bodily to the new site, and 80 new houses are either finished or under construction.

DISTRIBUTION TRANSFORMERS

THIS WAREHOUSE STOCK

COULD SAVE YOU...$24,000

General Electric's nationwide transformer stocks can save you heavy inventory expense

One Midwest utility, relying on the local General Electric warehouse for fast delivery and complete stock, cut back its distribution transformer inventory by an impressive $400,000. At a 6% carrying charge, this saves $24,000 per year—without including the hidden expenses of handling and storing the transformers.

G-E warehouses can cut your inventory costs. Open twenty-four hours a day for emergencies the nationwide chain of more than 100 General Electric and agent warehouses provides extra-fast delivery of G-E distribution transformers in all standard ratings. This service, can save you significant sums in inventory space and handling expense.

Look at the other money-saving features that prove "all transformers are not alike": Impulse testing, saves years of transformer life. **One-piece clamping bands** save maintenance time. Reusable **Nitrile rubber gaskets** help save units from contamination. **AL/CU terminals** are designed to prevent both copper and aluminum conductors from loosening. **Strenicor terminal clamps** save terminals from breaking. **Super Melaglyp** paint saves up to two repaintings. **Service shops** can cut your repair and rebuilding costs.

For the complete story, contact your nearest G-E Apparatus Sales Office or G-E Agent—or write to General Electric Company, Section 431–42, Schenectady 5, New York.

dollar-saving features prove ATANA*

***ALL TRANSFORMERS ARE NOT ALIKE**
(make this simple comparison and see)

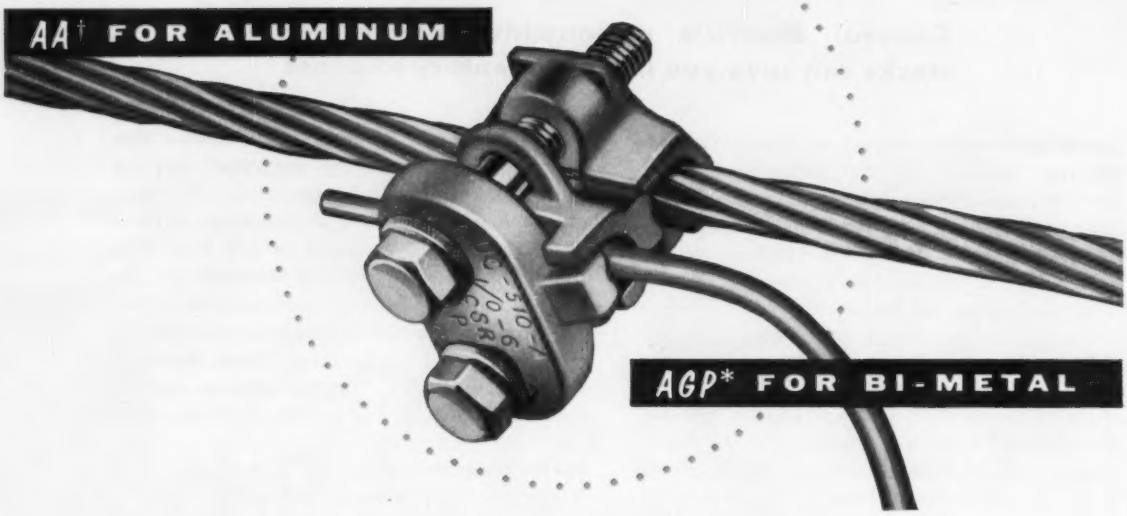
FEATURE	General Electric	Mfr. A	Mfr. B	Mfr. C	Mfr. D	Mfr. E
Production-line impulse testing	√			√		√
Nitrile rubber gaskets	√					√
One-piece clamping band	√					
H-v and l-v terminals handle both copper and aluminum conductors	√					
Strenicor pressure terminal clamps	√					
Super Melaglyp paint	√					
More than 100 warehouses	√	√				
Nationwide, company-operated service shops	√	√				

Progress Is Our Most Important Product

GENERAL ELECTRIC

CHANCE UNICLAMPS

for easy-to-make connections



Stock only two types for all conductor combinations — al to al, al to cu, cu to cu, or cu to al

This new Chance aluminum body Uniclamp is available uncoated for all aluminum connections, or with a coating of high-density Chance FORTIFIED cadmium—just like that used on AGP Tap Clamps—for all-purpose connections. Clamp body construction speeds installation since the clamp will not come apart — there's no danger of dropping loose bolts. The tight-fitting contact surfaces will withstand hundreds of high-temperature heat cycles to protect the conductor under surge conditions.

Chance Uniclamps come in 1/0 and 4/0 ACSR sizes and are suitable for all distribution service, light transmission service and loop dead-ending. These connectors are part of the *complete* Chance line which offers a wide variety of clamps and connectors to meet every need. See your Chance Distributor, or write A. B. Chance Company, Centralia, Missouri, for full information.

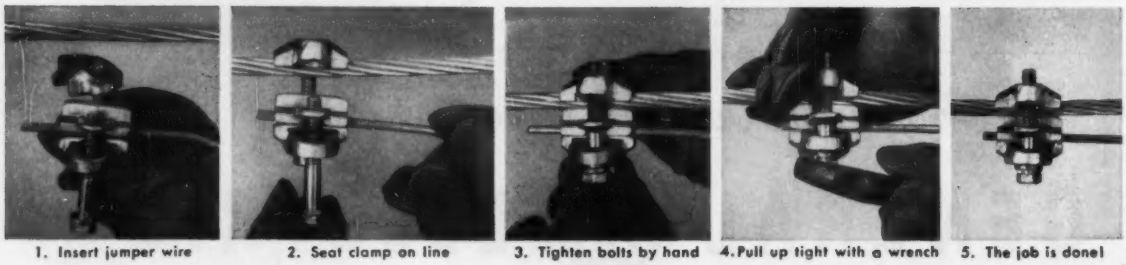
† Aluminum to Aluminum. * Aluminum General Purpose.

ABC INDUSTRIES

A·B·CHANCE CO·

IT'S EASY TO INSTALL CHANCE UNICLAMPS

CC56-10



1. Insert jumper wire
2. Seat clamp on line
3. Tighten bolts by hand
4. Pull up tight with a wrench
5. The job is done!

Summer Help: Good Bet for Future Employees

Association provides climate for permanent employment possibilities

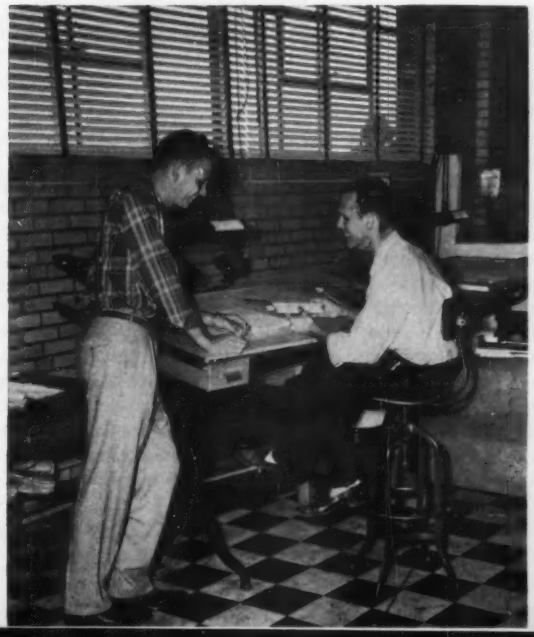
The hiring of young men and women on leave from school can often lead to an aura of mutual admiration. For the students it's a matter of needed cash, good experience, and a change from the sedentary routine. For the electric utility it sets up a tailor-made setting to study qualifications of students who may be back after graduation. The three months also gives a chance to build the company's standing with students and smooth over department dents that summer vacations invariably bring.

When Kansas Gas & Electric Co put on 17 engineering part timers, it started them off with a one-day orientation, including luncheon talks by Vice Pres–Operations S. J. Sickel, a tour of the properties and briefing on technical and economic facets of utility business.

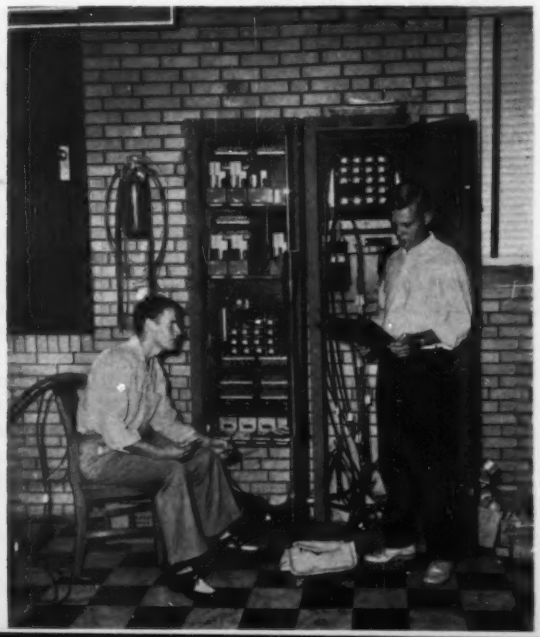
At Indianapolis Power & Light Co, 50 students were hired in the summer. Pictures here tell the story.

AT INDIANAPOLIS P&L Line Foreman Claude Kehl gives Jim Meyer, Purdue University junior, a preview of overhead distribution work they handled during the summer work period

FUTURE ENGINEERS Max Lees, left and Phil Kennedy help fill vacation dents at Indianapolis P&L. Lees is a senior at Purdue, Kennedy a Rose Polytechnical junior



DISPATCHING BOARD wiring receives serious views of Zoneal Moore, left, Louisiana Tech junior, and Bill Jones, Purdue junior. Both are electrical engineering students



Key to Good Farm Promotion: Informed Allies

National Power Use Workshop studies ways to increase consumption of electricity. Farm Electric Utilization Council may be made permanent

"Keep every ally fully informed of your farm power use promotion programs." That was the most prevalent plea of the score of speakers who came before the third annual National Power Use Workshop recently in Milwaukee.

The two-day gathering of some 600 industry representatives interested in promoting farm uses of electricity also offered:

- Numerous tips on farm power promotion programs, promotion organizations, and farm equipment.
- A low-pressure controversy between proponents of all-out and selective load building.
- An outline of one co-operative method for determining the "desirability factor" of various appliance loads.

In a brief business session, the Inter-Industry Farm Electric Utilization Council, which sponsored the workshop, elected N. Bernard Gussett, president, Iowa Power & Light Co, and A. F. Crowell, manager, First Electric Cooperative, Jacksonville, Ark., as new members of the six-man governing council. The group also voted to create a committee to study the merits of incorporating the council into a permanent and formal organization. The council, established three years ago, has been more or less an informal organization.

Keep Every Ally Informed

The need for keeping every interested segment of the industry and outside allies fully informed on promotional programs was voiced time and again by the workshop speakers. Most speakers agreed that power suppliers —electric companies, co-ops, or others —should coordinate the informational phase of the programs. Once a promotional campaign is planned, full resumes should go to dealers, distributors, contractors, farm organizations, government and educational agents. The resumes should let them know what is expected of them and discuss their roles in the program. It is important to keep them informed as the program develops, the speakers advised.

Four workshop panel discussions, comprising some 20 speakers, offered these tips for more effective promotional campaigns:

Organization—Hire a full-time employee for state-wide council activities. Keep standing committees to a minimum (it's better to set up task forces for a single project and dissolve them once project is completed). Make full use of existing organizations.

Financing—Some state promotional groups are levying 10¢ to 20¢ per farm meter on power suppliers to finance state campaigns. Utilities, dealers, and manufacturers are expected to carry bulk of advertising costs. In Ohio, financial accounting is handled through the state university.

Promotional programs—Such programs should be planned for a full year if they are to be wisely coordinated and effectively pushed. Maximum use should be made of the Council-sponsored "Sales Promotion Handbook" and the "1957 Farm Power Use Calendar." Once a program is completed, evaluate its results and determine how it can be made more effective.

Make Sure Electricity Is Used

Case for all-out load-building as a means of increasing net return was typified in a brief statement by Virgil H. Herriott, manager, Sioux Valley Empire Electric Association, Colman, S. D. He summed it up: "Let's be sure that the form of energy used on our farms is electricity and not worry so much about the demand of the individual pieces of equipment." Speaking out for selectivity, M. B. Penn, Alabama Power Co, cautioned: "If the chances of making the load profitable are remote, however, and if the job can be accomplished by other means, as in the case of certain irrigation and feed grinding loads, we should not hesitate to recommend that the customer use those other means."

Unusual method for determining desirable appliance loads was reported by Billie Bryan, Manager, Caddo Electric Cooperative, Binger, Oklahoma. This co-op has evolved a formula based on the ratio of revenue to profit for each of the appliances studied. Results of applying this "desirability formula" produces these ratings for the following appliances:

Appliance	Desirability factor (%)
Automatic Blanket	100
Home Freezer	95
Water Heater	93
Refrigerator	92
Bathroom Heater	84
Clothes Dryer	82
Automatic Washer	82
Electric Iron	80
Range	71
Room Cooler	57

Such an analysis requires that certain assumptions be made as to how the appliance will affect the peak demand of the system. This, of course, will vary with each system as to types of loads served, the hour, day and month of system peak, and whether a ratchet clause is contained in the wholesale power contract, Bryan explained.

S&S SHORTS

Sales Up Sans Fair Trade

Electric housewares sales are up 34% so far this year for Westinghouse Electric Corp. Increase is attributed to stepped-up merchandising and partially to abandonment of fair trade last year. Firm stated it had no quarrel with fair trade proponents but it didn't work for them.

Color TV: Next Year Maybe?

Industry opinion on the future of color television still is divided (EW, Aug. 16, p 126). David Sarnoff, chairman of Radio Corp of America, says there is strong possibility his firm could produce 500,000 color TV sets in 1957. But he admitted it will "take a little while" before the present low-level price of $495 for a 21-in. model will go lower. A few days earlier, Ralph J. Cordiner, president of General Electric Co, had stated that color television isn't ready yet.

- **Selective selling can overlook public's needs**
- **Let the customer do the load molding**
- **But utility should direct it . . . said this panel * at SEE Sales Conference where . . .**

Salesmen Seek to Delay Rate Hikes

Can the salesman stall a trip to the utility commission?

This was the job he was handed by Southern power companies last month at the Southeastern Electric Exchange's Sales Conference. Seriousness of the situation was sounded by the program's keynoter, W. J. Clapp, president of Florida Power Corp. "With increased costs facing us from all sides it's a question of how much longer we can keep our rates static," he said. "More sales to bring more net can help to delay rate increases."

The "More Sales, More Net" idea dominated throughout the conference. It was left to other speakers to examine how to do it. "Present usage and growth trends may point to a broader approach than selective selling," declared Tom D. Fulford, Virginia Electric & Power Co. "Let the customer do the load molding. If rates are properly designed with an eye to the future we need not fear the load of an appliance either singlely or collectively." Added W. C. McInnes, president, Tampa Electric Co: "We've got to sell our customers what they want."

"Selective selling acts to minimize the costs of serving electric power," said E. A. Wilson, Alabama Power Co, "but I wonder if selective selling can be too overweighted by the utility so that needs of our customers are overlooked." Hugh Isley, Carolina Power & Light Co agreed that while the utility can't dictate the customer's use, it can help to direct it. He sees electrically-equipped schools as a good balancing load. Big reason: It's a nine months operation which recedes entirely in the summer month peak period.

As for industrial loads, C. S. Reed, Duke Power Co, said rates, in order to serve the most business at the lowest rates, should follow the curves of the customer's ability to produce his own power. "I do not mean that we should charge what the traffic will bear," he explained, "but merely that we should charge in proportion to what the traffic will bear."

But it was residential load building which seemed to get most attention, particularly the Live Better Electrically and Housepower programs plus electric heating and the heat pump. LBE's Bob Ingmire foresees even greater manufacturer participation in 1957. Frigidaire Division, General Motors Corp, announced it will swing into the program, all General Electric Co TV commercials next year will carry LBE identification, and Westinghouse Electric Corp is offering LBE-Housepower TV spots to utilities for local use. The spots, which carry no Westinghouse identification, can be ordered from Edison Electric Institute.

Housepower will carry on in 1957 with EEI member companies contributing 2¢ per residential meter to support the basic program. W. M. Shepherd, Arkansas Power & Light Co, who heads the Housepower fund raising committee, said the program will be completely supported next year without a direct budget from EEI. To complement this, the National Adequate Wiring Bureau will up its ad budget 20% in '57 and plug its Housepower Rating Sheets by close kinship with the Housepower program, declared C. W. Higbee, chairman of Adequate Wiring Committee, National Electrical Manufacturers Association.

Some trouble spots in residential selling were pointed up by J. R. Pershall, Chicago advertising man and Westinghouse's W. B. Creech. Said Pershall: "Too much advertising is in terms of the utility's own load and service considerations and too little in terms of the customer's personal needs." Said Creech (speaking for Westinghouse Vice President Chris J. Witting): "Inject more showmanship into your work, rotate your appliance displays among manufacturers instead of showing a mixture of brands."

With that the conference moved into its committee sessions. What was said about the heat pump and resistance heating appeared in last week's issue (EW, Oct. 29, p 120). Reports of other proceedings follow:

RESIDENTIAL

To residential salesmen, promotion of lighting, quick recovery water heating, two-temperature refrigerators, and merchandising to the home builder were held out as ways to build sales and net.

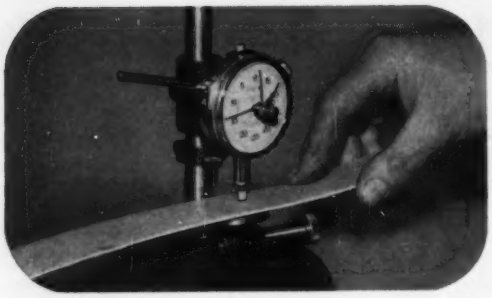
On lighting: Tests at two utilities indicate that for every $1 per cus-

(*Continued on page* 51)

*Hugh Isley, Carolina P&L, left; Tom Fulford, Vepco; E. A. Wilson, Alabama P&L

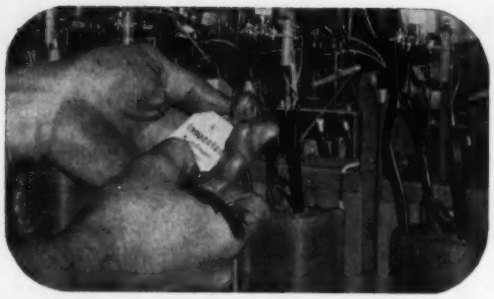
"Here's how every Kuhlman transformer gets 5 thorough quality checks before it's released for shipment..."

G. W. Miller
Supervisor of Quality Control



INCOMING MATERIALS CHECK—first step in maintaining traditional Kuhlman quality. All raw materials are carefully checked, upon arrival, against quality standards and original ordering specifications.

FABRICATION CHECK—many individual quality checks occur during fabrication. Photo shows coil being measured for dimensional accuracy. Tanks and cores receive similar rigid checks.



ASSEMBLY CHECK—as every Kuhlman transformer is assembled, there are scores of checks on clearances, connections and general construction. OK tag must be on every unit before it can be tanked.

LINE CHECK—double checking is required on Kuhlman's production lines. Here, complete and final checks are made of all construction, bushings, adjustments and connections before tank cover goes on.

FINAL CHECK—completing the cycle of 5 quality checks, final inspection is made on paint, gap settings, nameplate, accessories and other specifications. Only then is a Kuhlman transformer OK'd for shipment.

KUHLMAN
ELECTRIC COMPANY

5613

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA

Delaying Rate Hikes

(*Continued from page* 49)

tomer spent over 10 years of intensive promotion, $20.10 per customer is returned in revenue. Big obstacle to lighting sales, said M. G. Kennedy, Ebasco Services, Inc, is to overcome lack of creative retail selling and make it easier for the customer to buy.

On two-temperature refrigerators: They can give a utility an extra 390 kwhr use per year per unit, stated K. G. Roe, General Electric Co. And if only one-half of the 7,300 refrigerators replaced per 100,000 customers each year were two-temp units, the utility could gain $42,000 per year in extra income. His recommendation: Invest 42¢ per meter per year to sell it.

On merchandising to home builders: Divert some of monies spent on consumer and dealer promotion to a program aimed at the builder, urged Dwight Anneaux, Whirlpool-Seeger Corp. Instead of one or two appliances, the builder can sell four to six of them at one time with his house. There's a market of some 3.5 million appliances per year alone for new home construction.

On quick recovery water heaters: Water heater sales are 10% ahead of 1955 in areas permitting sale of quick-recovery units, declared GE's George Bogard—and 10% behind in the low-wattage, off-peak areas. One utility placed 9,600 quick recovery units into an area of 60,000 customers, served by eight substations, he said, and found its load factor virtually gained 1%.

AT SEE GENERAL SESSION—W. J. Clapp and J. S. Gracy, Florida Power Corp; R. E. Ingmire, Live Better Electrically. "More Sales, More Net" themed meet

RATE DISCUSSION—E. A. Snyder, AG&E; and C. S. Reed, Duke Power Co

COMMERCIAL

"Don't sell footcandles sell better lighting's benefits," J. M. Ketch, told the commercial group. "By using a visual selling approach—by demonstrating various lighting levels—we've found most prospects end up with values several times those which they had previously considered as enough." To set up the machinery for selling better commercial lighting, R. C. Paslay, Louisiana Power & Light Co, recommended the National Lighting Bureau's Certified Lighting program.

The profits in commercial cooking were spelled out by W. P. McPherson who said Carolina Power & Light now has 60,000 kw of equipment in use representing more than $1 million in annual revenue. "But commercial cooking is not a gravity business," he declared. "Practically every sale we make is in direct competition with flame-type fuel." Carolina's sales formula: Customer survey, adequate sales training, liberal support of service outlets, dealer cooperation, and year-round promotion.

Hand in hand with plans for commercial load building came another matter for utilities to think about—higher voltage service. "Unless we go to higher voltages for even residential services, every time we look out the window we will be staring directly at a large transformer, or maybe a 'bank in every basement' will be our motto," warned Allan C. Mustard, South Carolina Gas & Electric Co. Discussing 480 wye-277-v service, he felt cost problems could be licked as experience in design, installation, and use is gained.

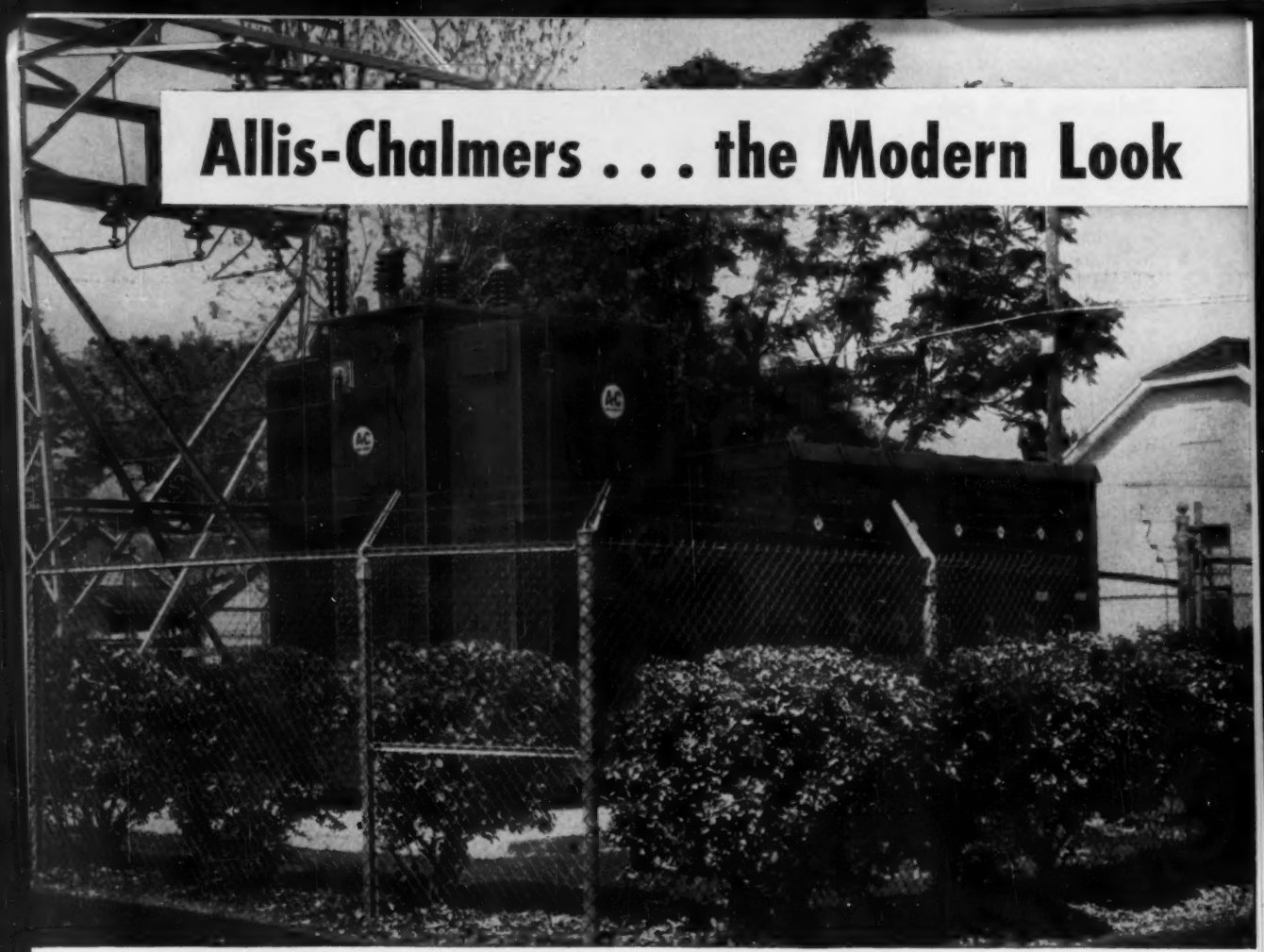
PR & ADVERTISING

"I hope you guys learn how to talk before its too late," said Loyall Phillips, publisher of the St. Petersburg Independent. Tell what you are doing to help your customers and the facts about public power, which is the first step to socialism. If a rate increase is needed, convince the public through effective selling of the value of service.

Advance education is the best way to forestall future bill complaints, declared G. F. Cook, Virginia Electric & Power Co. "Let the customer know that his bill is on the upgrade. Bad news loses most of its terror if we know it is coming." And when handling bill complaints, go on the offensive rather than the defensive, urged G. S. Dunn, Appalachian Electric Power Co. Assume that the customer uses too much electricity and get him to talk while you listen. Ask him what he is doing with it. In this way, the customer usually convinces himself that conservation is desirable, but he will continue to consume as much because of convenience.

Getting the employee on the sales promotion team is a job of communications and having him use appliances. To get employee cooperation, W. P. Corley said Georgia Power Co recently set up a selective mailing list that reduces paper going to employees by 50%. This allows employees more time to read promotion material as

(*Continued on page* 55)



Allis-Chalmers . . . the Modern Look

Allis-Chalmers unit-subs offer a 3-way

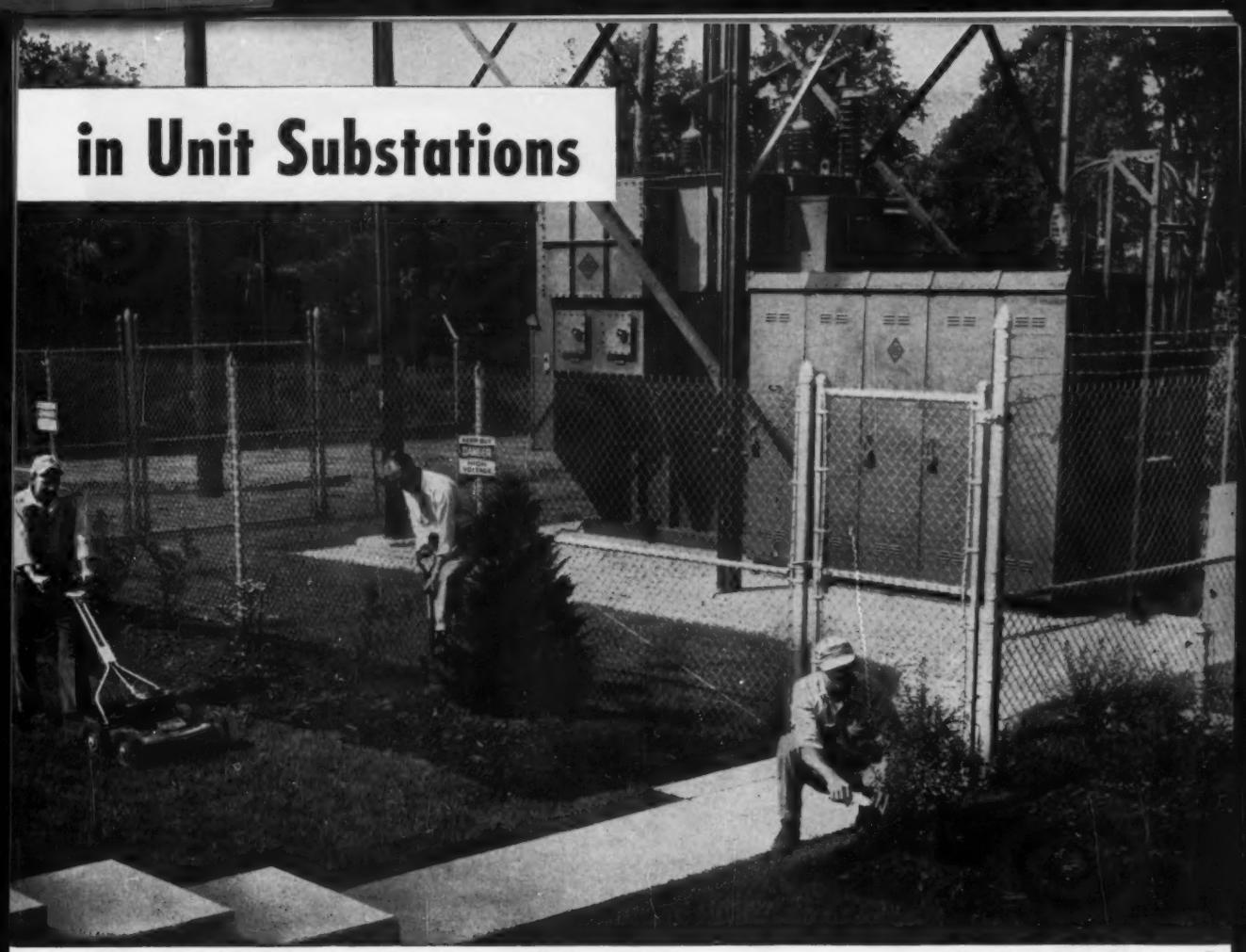
Safety - Convenience

Safety—
Further improve your high safety standards with such features as:

- Mounting of potential and control transformers on drawout carriages for complete isolation of primary and secondary contacts during inspection.
- Automatic, positive-acting shutters to isolate high voltage contacts when breaker is withdrawn . . . *not dependent on springs or gravity.*
- Complete steel barrier compartmentation, flame retardent insulation, and safety interlocks.

Convenience—
Here's a typical convenience extra found in all types of Allis-Chalmers switchgear. You can move breaker to test, or even fully disconnected position inside cubicle . . . *and still close the door.* No special storage space is required for breakers not in use . . . handling is reduced.

ALLIS-



in Unit Substations

answer to your system growth problems

- Versatility

Versatility—

You can build *today* with an eye to the *future* with Allis-Chalmers standardized construction:

- Additional circuits may be added easily due to grouped control wiring . . . dry bus joint . . . jig-built construction.
- Transformers of larger capacity may be substituted without changing throats.
- Current transformers with higher ratios can be substituted. All have same mounting dimensions.
- Major components are interchangeable.

In addition, there's ease of installation, and extra reliability built into Allis-Chalmers switchgear. For the answer to your system growth problems, call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

CHALMERS

A-C ALLIS-CHALMERS

A-5147

HALF A MILLION TO PROVE THEY'RE RIGHT!

Almost 20 Years of Service Prove O-B Clamptops Reliable, Practical and Economical

Yes, we know it seems like "only yesterday" but the truth is that it's been almost 20 years since O-B introduced the Clamptop method of attaching insulator to conductor. More than half a million multiparts and line posts using the clamptop feature have been placed in service. In 1937, we pointed out these advantages of the clamptop design:

1—Elimination of abrasion on conductor
2—Superior performance under vibration
3—Elimination of tie-wire failures, and outages due to such failures
4—Good radio influence characteristics
5—Elimination of uneven sag conditions
6—Greater speed and safety in hot line work

Almost 20 years later, we can not only repeat these claims, but point to the more than half million units in service which prove the benefits of the clamptop design.

If you aren't already using clamptops—available on both multiparts and line posts—don't you think it's time to give the idea serious consideration?

4679-H

Ohio Brass

MANSFIELD, OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

Delaying Rate Hikes

(*Continued from page* 51)

well as other papers they receive. Readership was also increased by personalizing promotion material with names printed on the Addressograph.

Rising costs of TV time is forcing some Southeastern utilities to consider dropping sponsorship of programs. E. N. Pope cited doubled costs during the past two years as the reason Carolina Power & Light Co may use only spot commercials in the future, as some companies do now.

Utilities are inclined to promote items that they think the customer wants rather than base promotions on studies of what the customer actually wants, declared O. H. Broadway, Carolina Power & Light Co. This district operating executive also suggested that utilities should merchandise advertising to employees, use vehicles as traveling signs, work human interest events into advertising, and keep the message simple.

Editors of house organs can do a great deal for their companies if they are relieved of irrelevant jobs and given encouragement, said Peter Helmers, Detroit Edison Co.

RESIDENTIAL SESSION—V. P. Gayle, Gulf States Utilities; S. L. Forsyth, Westinghouse; and Kenneth G. Roe, General Electric talk heating and refrigeration

INDUSTRIAL SESSION—R. F. Tucker, Allis-Chalmers; C. J. Ellis, GE; T. D. Hoskins, Louisiana P&L; Drayton Heard, Westinghouse discuss automation trends

INDUSTRIAL

Creative selling is the biggest problem facing utility power sales engineers today, reported Drayton Heard, Jr., Westinghouse Electric Corp. Other problems in order of importance revealed by a survey of utilities throughout the country included manpower, load molding, area development, and mass selling.

Heard also urged the industry to sell the idea of automation for two reasons: To help customers improve operations and remain competitive, so they remain customers; and to sell more power through automation.

Nuclear energy applied to industry will advance automation and, thus, increase power sales, declared C. J. Ellis, General Electric Co. Radioactive isotopes are already being applied to nondestructive testing and inspection, gaging and control, tracing, and static charge neutralization. Still more applications will be found in the future, including improvement of properties of materials by irradiation.

Expansion and growth of industrial power systems is responsible for most misapplications of large air circuit breakers, pointed out R. F. Tucker, Allis-Chalmers Manufacturing Co. These misapplications stem from lack of knowledge of fault current calculations and of the method for determining interrupting ratings.

The Germanium rectifier will be used more in the future than the mechanical or selenium rectifier, predicted H. B. Greear, General Electric Co. It is simple and its efficiency approaches that of the mechanical rectifier. When compared to the selenium rectifier, the smaller germanium rectifier has a longer life and better voltage regulation.

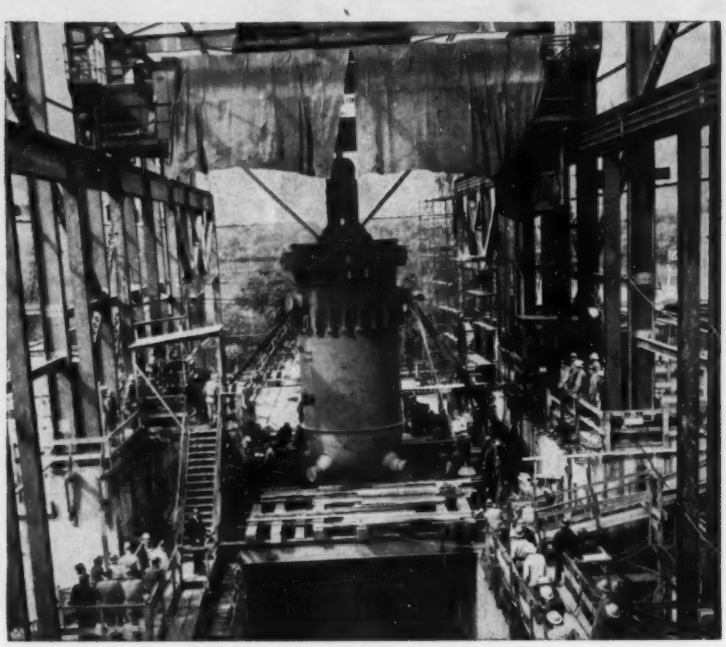
RURAL

A number of different type electric brooders for chicks have been accepted by farmers in the Southeast, and a new type is under development. This latter one, said M. T. Geddings, Duke Power Co, is a pad of strong laminated structure containing a 800-w element and a thermostat on the top surface. The pad is placed on litter under a flat hover, which has 2 in. of litter on top for insulation. Preliminary test results indicate that this brooder may be practical and economical, and a 2-hour interruption with a surrounding temperature of 30F is not harmful.

Although infrared lamps have been used by many Alabama poultrymen, radiant floor brooding has been catching on fast, reported M. B. Penn, Alabama Power Co. Last year 2.5 million chicks were brooded on concrete slabs, averaging 7.3 mills per chick for electricity. This cost is less than for infrared, heat is controlled more accurately with a sturdier thermostat, and rate of heat loss is less during outages.

Louisiana Power & Light recommends infrared brooding for backyard flocks and laying hens and underheat for broilers, said A. J. Rhodes. Underheat brooders are either portable, semi-permanent, or permanent installations.

The portable ones consist of heating cable placed on insulating board, enclosed with ¾ in. of sand and topped with durable sheathing. Where less portability is desired, the heating cable is embedded at the top of a 4-in. layer of sand and covered. Such a brooder housing 1,000 chicks was subjected to a 24-hour outage during freezing weather; only two chicks perished. Permanent brooders for broilers, said Rhodes, are composed of heating cable embedded in concrete slabs.



Reactor Shell Enters Its Container

The reactor pressure shell for America's first nuclear reactor for commercial electric power (EW, Oct. 8, 1956 p 52) is shown being placed in its container at the atomic power plant at Shippingport, Pa. Built by Combustion Engineering Co for the plant which Westinghouse Electric Co designed for the Atomic Energy Commission, the vessel will hold the uranium core that actually generates the heat necessary for the production of steam. Duquesne Light Co, who is building the steam turbine generator portion of the plant, will operate the entire plant for AEC. It is expected to be completed in 1957.

Duncan Develops Meters of 'Dual Range' Type

Recent developments by the Duncan Electric Mfg Co of Lafayette, Ind., are two "Dual Range" single-phase thermal demand meters. They are the Type TF-SD single-phase, 50-amp, 240-volt, 3-wire, 24/48-kw for metering loads up to 200 amp, and the latest Type TK-SD single-phase, 15-amp, 12/24-kw for loads to 100 amp.

Like the TF-SD, the Type TK-SD is actually two meters in one. It allows a choice of scale capacity of either 12 or 24 kw. Thus, the meter may be matched to the load being measured.

From an economic standpoint, the dual range of such meters is said to minimize the user's investment in metering equipment, afford a time and labor savings in changing meters, and provides simplification of stocking meters.

'Powerupter' Developed by H. K. Porter Co

The development of refinements on interrupter switches by Delta-Star Division of H. K. Porter Co., Inc., Chicago, has resulted in a line of interrupter switches designated MKR-40 Powerupters. These switches are designed to permit the interruption of currents to 600 amp, without danger of external arcing or flame.

They combine the features of a standard group-operated vertical break switch and a recently designed interrupter having a double-acting mechanism to assure instant arc extinction, either in opening or closing circuit. Laboratory and field tests indicate that at rated values interruption occurs in less than one cycle.

RCA Will Build Microwave Link for PG&E

The Communications Products Department, Radio Corp of America, has received a contract for the installation of a 10-station microwave relay system for Pacific Gas & Electric Co of San Francisco.

The multi-hop RCA system will provide 13 channels for voice communications among key installations of the California utility. It will extend 282 miles, linking Pacific Gas & Electric Co facilities between the San Francisco home office and a branch office in Red Bluff, Cal.

The installation will utilize CW-20A microwave equipment, and will incorporate wide baseband facilities which are said to permit expansion of the system from 13 to 48 channels.

GE Opens Laboratory for Lubricants Research

General Electric Co recently opened its $1 million bearing and lubricant center at Schenectady, N. Y. It is said to be the largest test and development facility of its kind in American industry.

Dr. Robert O. Fehr, manager of mechanical engineering for GE's General Engineering Laboratory, said the new center is equipped to carry on advanced development work relating to atomic submarines, jet engines, missiles, satellites and "constant improvements in turbines, motors and household appliances." Lubrication work will include investigations and development of oils, greases, synthetic and solid lubricants. It will also act as a consulting service for the company's product departments.

In addition, some revolutionary

(*Continued on page* 59)

This typical test station in Florida exposes Sangamo J2 Meters to salt vapor atmospheres as part of Sangamo's continuous program of improvement.

Field tests prove corrosive atmospheres can't hurt J2 Meters

Longer meter life—even under the worst possible service conditions—is the subject of constant study and research at Sangamo.

The findings of continuous field tests since 1952 at salt atmosphere test stations on the coasts of California—Texas—Florida . . . corrosive industrial atmosphere stations in chemical industry areas, are the basis of the corrosion-resistant design of the J2.

All external and internal meter parts are given complete protection against all conditions of outdoor exposure. The use of rust inhibitors, oxide films, inorganic seals and special plating on all metal parts and the inert organic Selkyd meter base assure many years of maintenance-free service under the toughest conditions.

And remember, the J2 Meter is the *slow speed* meter—only 10 revolutions per minute at full nameplate rating—another reason why the J2 is your best investment in a watthour meter.

Live Better Electrically

SANGAMO

SANGAMO ELECTRIC COMPANY

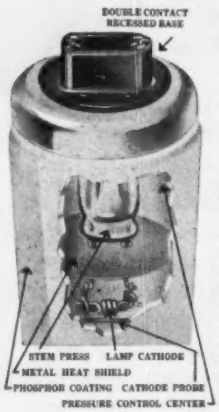
SPRINGFIELD, ILLINOIS

JM56-7

Sylvania's VHO lamp makes possible more light per foot from fluorescent lamps

Produces more than twice the light output of conventional 40 watt lamps!

Sylvania Research conquers Heat and Pressure—two major obstacles to more light per foot!



The VHO-lamp represents an entirely new concept in lamp design—an entirely new way to get more light per foot from fluorescent lamps.

To make this achievement possible Sylvania engineers have developed and combined these vital features:

1. New "Pressure Control" Center. The specially developed, exclusive internal end construction of the VHO lamp creates "cool spots" at each end which allow mercury to condense.

2. Neon gas replaces Argon. Sylvania discovered that Neon actually gives far greater efficiency at higher wattages than the conventional Argon.

3. Use of standard T-12 bulb. The popular T-12 bulb permits maximum effective production and use of ultraviolet radiation within the tube.

4. The Patented Sylvania Rapid Start System. This development for fluorescent lamps keeps filaments warm during operation of lamp, and encourages effective electronic emission from filaments at all times.

IN APPEARANCE, the VHO-25 is a standard 4-foot T-12 lamp, yet it produces *more than double* the light output of 40-watt fluorescent lamps made until now.

Due to the substantially greater light output of the Sylvania VHO, High-Bay Industrial Fluorescent lighting becomes practical and economical. In Low Bay lighting, VHO lamps will, in many cases, prove more economical because fewer fixtures are required.

VHO lamps are also a new and practical answer to better, highly efficient street lighting . . . use a minimum of lighting units of less cumbersome size. They are also particularly suitable for other outdoor lighting applications such as store fronts, service stations, and floodlighting of outdoor industrial or commercial areas.

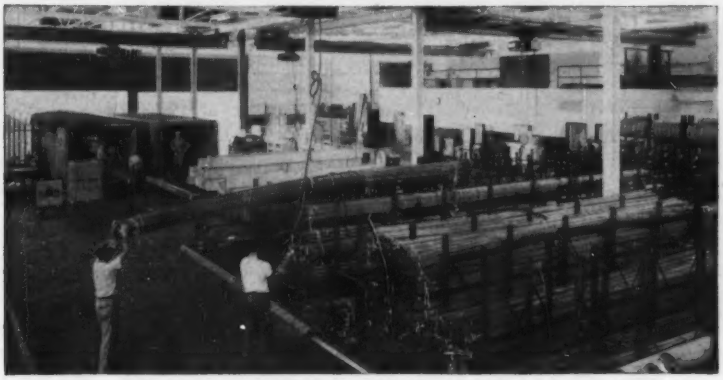
If you are considering plans which include lighting for new construction or modernization, the new Sylvania VHO fluorescent lamp will be of particular interest to you. For complete details consult your local Sylvania Representative, or send today for your free folder about the revolutionary Sylvania VHO Rapid Start Fluorescent Lamp. Write to:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Dept. C, Salem, Mass.
In Canada: Sylvania Electric Products (Canada) Ltd.
Shell Tower Building, Montreal

SYLVANIA

. . . fastest growing name in sight

LIGHTING • RADIO • TELEVISION • ELECTRONICS • ATOMIC ENERGY



American Brass Co Opens Warehouse

New copper and brass warehouse has been opened in Cleveland by American Brass Co, a subsidiary of Anaconda Co. The facility has 30,000 sq ft of floor area, is crane-covered, and has power tools for sawing, shearing and splitting operations. Serving the warehouse are an inside rail siding and a shipping bay for four trucks. Harry M. Paxson is the company's district sales manager.

GE Opens Lab

(*Continued from page* 56)

concepts are being studied, such as air bearings which greatly minimize or eliminate friction; the use of molten metals and glasses as supersonic lubricants; and concepts of balanced gravitational and mass forces, which have caused the earth to rotate on its axis since the beginning of time without bearings and lubrication.

Dalles Bids to be Opened

Corps of Engineers, Portland, Ore., announced that it will open bids for six 82,105-kva generators for the Dalles power station on Dec. 4 at 2 p.m. The work calls for the design, manufacture, delivery, installation and test of the units—all to be completed by Nov. 1, 1960.

U. S. Aluminum Production

Primary aluminum output in the U. S. during September was 132,316 tons, an increase over August of almost 40,000 tons, according to the Aluminum Association, New York. This increase represents part of the recovery of the industry's output from the decreases that was the result of the nine-day strikes at Aluminum Co of America and Reynolds Metals Co plants during August. Total production for the first nine months of 1956 reached 1,236,650 tons. This is almost 80,000 tons more than that of the first nine months of last year, despite the strike.

B&W Gets Licenses

Babcox & Wilcox Co, 161 E. 42 Street, New York, N. Y., has obtained general licenses from the Atomic Energy Commission to receive and use special nuclear and nuclear-source materials. The five-year licenses apply to fuel element production at the company's Nuclear Facilities Plant at Lynchburg, Va. In this connection, B & W reports that it has reduced production time in the making of MTR fuel elements at the Lynchburg plant. The elements are being made for Phillips Petroleum Co.

B & W also reported that it has received a contract to design and engineer a nuclear research reactor for Kernenergie Hamburg, the Society for the Utilization of Nuclear Energy in Shipbuilding and Navigation, Inc.

U. S. Copper Production

Copper production in the U. S., according to the Copper Institute, New York, is as follows: Primary production amounted to 88,885 tons in September, a decrease of almost 2,400 tons from August. Refined production was about 112,480 tons for September, down 9,620 tons from August. Deliveries to fabricators amounted to 104,480 tons, or about 5,130 tons less than August. Refined stocks totalled 93,200 tons in September, down almost 3,250 tons from August.

Manufacturers' Earnings

Company	Period Months	Period Ended	Net Income 1956	Net Income 1955	Earnings Per Common Share 1956	Earnings Per Common Share 1955
Allis-Chalmers Mfg Co	9	Sept 30	$15,713,180	$18,146,517	$1.87(a)	$2.21(a)
Amer Tel & Tel only	3	Sept 30	152,370,000	139,236,386	2.70(c)	2.74(c)
Buffalo Forge Co	3	Aug 31	416,915	340,297	0.64	0.52
Castle & Co, A. M.	3	Sept 30	528,543	474,485	1.10	0.98
Dow-Chemical Co	3	Aug 31	11,275,315	11,723,647	0.47	0.51
Driver-Harris	3	Sept 30	141,539	147,156	1.59	1.65
General Electric Co	9	Sept 30	160,727,000	152,926,000	1.85	1.76
General Cable Co	9	Sept 30	8,725,628	4,202,434	3.06(a)	1.76(a)
Gulf Oil Corp	3	Sept 30	68,197,000	53,416,000	2.42(a)	2.09(a)
Hooker Electrochemical	9	Aug 31	8,638,400	7,762,900	1.41	1.27(b)
Johns-Manville Corp	9	Sept 30	18,972,546	16,441,242	2.95(c)	2.58(d)
Minn-Honeywell Reg	9	Sept 30	14,555,397	11,536,894	2.20(e)	1.79
Porter Company, H. K.	9	Sept 30	5,636,924	3,112,844	5.24	3.00
Radio Corp of Amer	9	Sept 30	27,893,000	30,995,000	1.81	2.04
Revere Copper & Brass	9	Sept 30	7,066,819	8,144,765	2.70	3.15(d)

Notes—(a) Based on shares outstanding at close of period. (b) Based on shares now outstanding. (c) Based on average number of shares outstanding during the period. (d) Adjusted to reflect stock split or stock dividends. (e) Adjusted for conversion of preference stock.

BUSINESS OUTLOOK

Electrical World
NOVEMBER 5, 1956

Industrial production, as measured by the Federal Reserve Board's index, shook off the summer doldrums in September. It rose to 144 from the August level of 142. And in doing so, it tied the all-time record set last December. The turn-up was especially heavy in the durable goods industries, whose output rose from 159 to 163

The September performance is an especially bright omen for the final quarter. The surge in production of durables occurred despite the drop in auto output that month. This development illustrates the fact that there has been a strong underlying demand to sustain the economy this year even when auto production has been slack. And for the fourth quarter it clearly means that total industrial output is certain to rise substantially after the auto industry swings into full scale production.

• • •

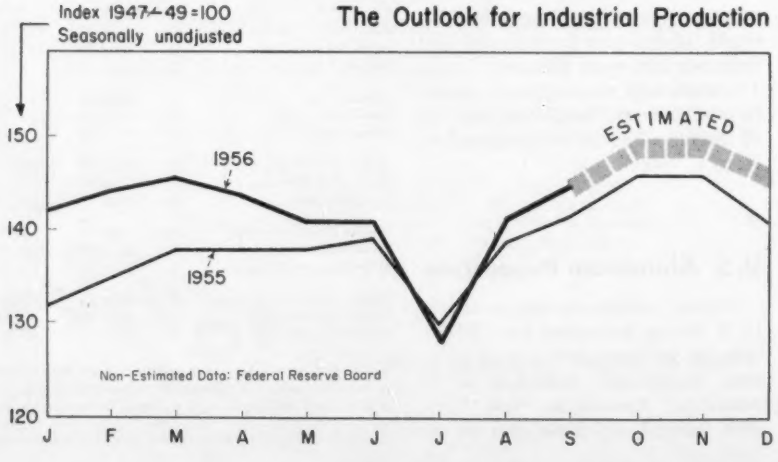
A large part of the strength in September came from the steel industry. Steel mills have operated at over 100% of normal capacity since mid-September. A part of the frenzied pace has stemmed from pressure to fill a heavy backlog of orders for the new auto models that need more steel than last year's. But orders have also been strong from the construction, petroleum and machinery industries. As things stand now, steel mills have enough orders on their books to keep running at above normal capacity well into next year.

Not all producers of primary metals have made out as well as steel mills. The demand for copper has been slipping. Deterioration of both foreign and domestic demand has caused domestic refiners to cut prices from 40¢ to 36¢ a pound. This is the second sharp adjustment in copper prices to take effect in the past few months. There was a cut from 46¢ to 40¢ in July.

• • •

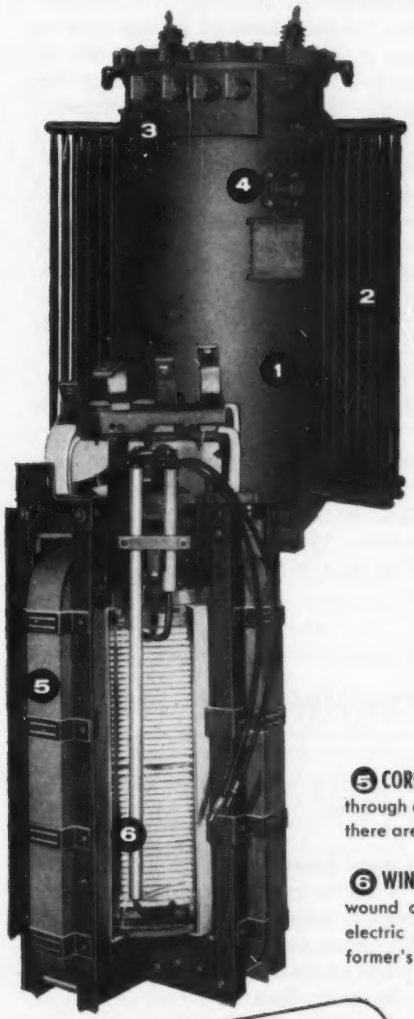
Corporate profits this year will probably run slightly above last year's pre-tax total of $42.7 billion. The rate for the first two quarters exceeded last year's annual rate. But the steel strike and the sag in auto sales have clipped down the third quarter figures. And, wage increases have preceeded price increases by several months. Undoubtedly fourth quarter profits will pick up as industry in general operates at top speed, and as some of the price increases earlier in the year take effect. On this basis, profits for the year are likely to average out around $43 billion.

The Outlook for Industrial Production



Wagner Form W Substation Transformers

...in ratings through 500 kva, voltages to 67,000



Wagner Form W Transformers are available for every requirement of modern distribution systems—from 3 to 500 kva, with high voltages from 480 to 67,000 volts. In all ratings you get the excellent performance and complete dependability for which Wagner Transformers have been noted for 65 years . . . plus the compact design and light weight that makes Wagner Form W Transformers easy to handle and install.

Check these important features of 250 to 500 kva ratings:

1 HOUSED IN ROUND TANKS . . . inherently strong . . . compact . . . light in weight.

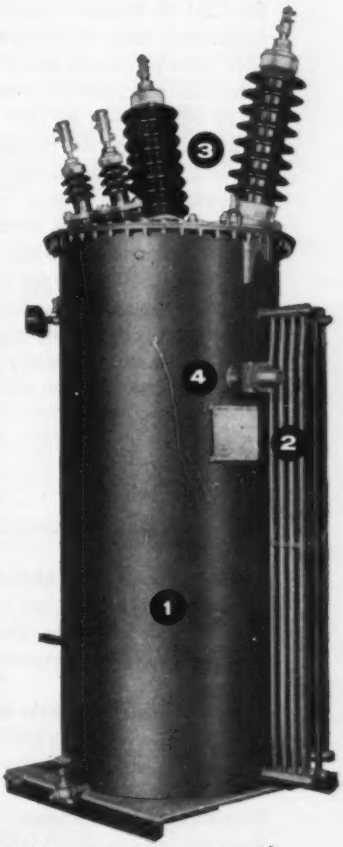
2 ELLIPTICAL TUBE RADIATORS for efficient cooling . . . provide maximum radiating surface in minimum space.

3 BUSHINGS ASA standard high voltage bushings on transformers 23 KV and above (right). Locked tank wall bushings on transformers with low voltage ratings, 600 volts and below, (left).

4 WEATHER-PROOF, TAMPER-PROOF TAP CHANGERS . . . operating handle is protected by cover which shows tap position . . . can be padlocked.

5 CORES are of cold-rolled, oriented grain steel, wound through and around the coils. In ratings from 250 to 500 kva, there are 4 core sections spaced 90° apart.

6 WINDINGS . . . high voltage and low voltage coils are wound on insulating cylinders of high mechanical and dielectric strength . . . the winding best suited to each transformer's rating, voltage and current is used.



Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner maintains a nationwide organization to provide fast, convenient service with branches in 32 principal cities.

T56-15

Wagner Electric Corporation
EST. 1891

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES · AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC

A Peek at the Future Farm Power Market

The nation's farms—at least the two million which produce about 88% of the farm commodities—offer one of the richest markets for future sales of electric power. You'll find general agreement on that.

But when you come down to the scope and size of this farm power market, you run into understandable differences.

In an avowedly conservative study early this year (EW, Feb. 13, p 21), we foresaw annual farm power sales in 1965 of around 40 billion kwhr—about double the market of last year. We also forecast a doubling in average farm power use during the ten-year period.

GE Study Shows 70 Billion Kwhr Market

A more recent and less conservative study made for Karl H. Runkle, General Electric Co's manager of industry sales development, indicates a considerably more promising market. From 23 billion kwhr sales this year, the GE study indicates an increase to 70 billion kwhr in 1971. And in the foreseeable future, according to Runkle, average farm use for production purposes is expected to be 10 times present consumption. Today, says Runkle, the average industrial worker uses some 20,000 kwhr a year to help him do his job while the average farmer uses less than 1,500 kwhr for producing farm products.

Background for Runkle's figures—a 35% increase in general population—50 million more mouths to feed—possibly further decline of less profitable farm units—adds weight to the results. He's not likely to run into open argument from electric utility men, who are accustomed to surpassing even the most optimistic forecasts.

Daring Innovations Already Underway

Some hint of future farm uses of electric power comes from experiments now in progress. Cathode-ray bombardment may become a common food sterilizer and help prolong storage periods. It's already been demonstrated at Brookhaven National Laboratory that medium doses of gamma rays on potatoes caused them to show no sprouting and no softness as much as 18 months after exposure. An electronic machine developed by the Department of Agriculture detects green rot in eggs. Numerous other such experiments are underway.

And Runkle takes a bright-eyed look at some of the things that might possibly be developed to ease farm work tasks and increase use of electricity:

- A $2 million poultry project for egg production all electrically operated.
- Remote controlled drones could spray fields electrically.
- Electric fence gates combined with high frequency sound might combine for an electric round-up of cattle.
- Supersonics might be used to drop fruit from trees into nets and thence to conveyors.

Absurd? Asks Runkle.

And the answer: "Some maybe are. But none is as absurd as it would have been five to ten years ago."

TECHNICAL NOTES

Solids concentrations of 1 or 2 ppm have permitted satisfactory operation of a subcritical one-through boiler. But feedwater with total solids under 0.5 ppm is required for supercritical operation.

Solar energy available in the U. S. varies between 0.8 and 1.1 kw per sq meter depending on location and atmospheric conditions.

Buried-cable distribution must allow for future load demands to avoid costly reinforcements.

A mathematical method for determining the length of a meterman's route equalizes work loads and improves employee relations for Mississippi Power & Light Co. Factors plugged into the equation include number of meters, milage, and type of terrain.

Templates for panel board layouts permit the accurate locating of instrument positions and mounting holes in minutes as contrasted with several hours required by the former method at Idaho Power Co. With the templates all lines and holes can be located quickly after the center lines have been drawn on the panel.

Mercury-vapor and fluorescent street lamps powered from multiple systems find starting power available in the distribution network that must be reserved in constant-current transformers of the series system.

Rate Cuts Approved for Two Utilities

Illinois and Oklahoma Commissions direct companies to reduce rates. Illinois body aims at 5.9% return. Oklahoma rate gives break for electric house heating

Regulatory bodies in two states have approved rate reductions for electric utilities under their jurisdiction.

The Illinois Commerce Commission has ordered Central Illinois Public Service Co to reduce rates by approximately $1.1 million annually. The rate cut is evidently aimed at holding the company to a 5.9% return on investment. Revenue had run slightly higher than that because the company sold energy to Electric Energy, Inc, beyond the period provided for in its original contract.

The Oklahoma Corporation Commission has approved a rate reduction for Oklahoma Gas & Electric Co amounting to $590,000 annually, mostly through revision and simplification of rate schedules.

The Commission's order said: "The proposed revisions include the reclassification of the company's residential and General Service rate schedules so that the classes of communities have been reduced from six to four. This reclassification would result in reductions in revenue to the Company in the majority of communities served by the Company, the total reduction amounts to approximately $413,209.

"Another revision proposed in the Residential schedules provides for the removal of certain clauses, which previously had under certain conditions provided for the increasing of the customer's billing for horsepower load in excess of three horsepower. Also, from the Rural schedules certain provisions would be removed which have previously provided for excess charges for transformer capacity supplied by the Company in excess of five kva. These changes would result in an annual reduction in revenue to the Company of approximately $38,553.

"Reductions in the level of the rates are proposed in the two Rural schedules which would amount to a rate reduction of approximately $138,310 annually.

"Certain changes in the County, Municipal and School rates are proposed in order to bring these schedules into line with the proposed reclassification of towns under the Residential and General Service Schedules.

"A new rate designated as HR-1, Residential Rider for High Winter Usage, is proposed as a schedule specifically applicable for service to customers using heat pump year round air conditioners and space heating equipment."

Memphis Prepares for Big Bond Sale

The Memphis Light, Gas & Water Commission will sell about $155 million worth of revenue bonds this month to finance the new municipal electric power plant.

That is the estimate of Maj Thomas H. Allen, president, after a discussion of the plant's feasibility report with members of the city commission.

"The amount of the bond issue will depend on the interest rate which we will have to pay," Major Allen said, "and the total should be between $155 and $157 million."

The utility president said the cost of the plant itself will be about $121 million and the additional money will be for modification and expansion of the MLG&W distribution system.

Copies of the feasibility report, which sets out a financial program for the utility's electrical division for the next ten years, have been distributed to members of the city commission for detailed study.

Mayor Edmund Orgill said another meeting with MLG&W officials will be held later.

"The report is ready except for a few minor corrections," Mayor Orgill said. "There are some items which the city commission and the MLG&W want to discuss further.

"Each commissioner has a copy to study and we will meet again with the MLG&W Commission later for a complete discussion."

He said the next step will be to distribute copies of the report prepared by the consulting engineers, Burns & Roe, to potential bond buyers.

"Our financial advisers, Salomon Bros & Hutzler, will tell us what they think about how to sell the bonds so the city will pay the lowest possible interest rate, he said. "The sale will not be before November, and it has not been determined just when the financial advisers will come to Memphis to discuss the sale."

Major Allen assured that local rates after the new plant goes into operation will be comparable to those charged by the Tennessee Valley Authority, the city's present supplier under a 20-year contract which expires June 30, 1958.

FINANCIAL BRIEFS

Consolidated Edison Co of New York, Inc, has arranged with 15 local New York City banks for a $100 million credit to run until Oct. 8, 1957.

Portland General Electric Co has placed privately $16 million first mortgage 4¼% bonds due 1986 through Blyth & Co.

Southern Canada Power Co will pay November 15 a quarterly common stock dividend of 62½¢ a share as compared with 50¢ a share in the previous quarters and 25¢ extra in August.

Future Financing

November Financing Light

Pacific Lighting Corp postponed sale of $20 million preferred stock until after election day. November will be a light financing month for utilities with only $115 million scheduled so far and these are well spaced. Calendar is relatively thin through the remainder of 1956.

Mostly for Debt Issues

Sale of debt issues continues to dominate the market. More than 80% of the amount scheduled for first three months of 1957 will be in mortgage bonds and debentures.

Heavy Schedule in Early '57

Companies which deferred this year's financing to early 1957 will find stiff competition for funds. Already scheduled for the first quarter of 1957 are issues totaling $390 million. Electric and gas companies postponed $185 million new securities offerings to 1957 and this amount is included in the $390 million figure.

Due Diligence Meetings

November 8, Public Service Electric & Gas Co; November 14, Arizona Public Service Co; November 16, Texas Power & Light Co; November 29, Long Island Lighting Co; November 29, Dallas Power & Light Co; December 6, Florida Power & Light Co; December 6, Delaware Power & Light Co, and January 11, Louisiana Power & Light Co.

(Furnished by the Irving Trust Co from the Financing Calendar)

DATE	COMPANY	Amount of Offering (Millions) DEBT	EQUITY
NOV. 1	National Bank of Detroit	$.....	$14.0-N-rt COM
1	Allied Stores	15.0-N	.....
8	Northspan Uranium Mines	45.0-N	.....
14	Public Service Electric & Gas	50.0-C	.....
15	Sinclair Oil	170.6-N-cv-rt	.....
16	Chase Manhattan Bank	.....	.....
20	Texas Power & Light	10.0-C	.....
20	Greenwich Killingly Expressway	75.0-C	.....
21	Arizona Public Service	.....	15.0-N-cv Pfd
NOV. No Date	Transcontinental Gas Pipe Line	20.0-P	.....
	Pacific Lighting	.....	20.0-N Pfd
DEC. 3	U. S. Governments	9,100.0- -R	.....
3	Dallas Power & Light	10.0-C	.....
4	Michigan Bell Telephone	30.0-C	.....
4	Public Service Electric & Gas	.....	35.0-N COM
4	National Cash Register	28.3-N-cv-rt	.....
5	Long Island Lighting	20.0-C	.....
11	Florida Power & Light	15.0-C	.....
11	Delaware Power & Light	.....	8.0-C Pfd
DEC. No Date	Massachusetts Port Authority	115.0-C-R	.....
	Texas Eastern Transmission	40.0-N	.....
4th Quarter of 1956 (Month not indicated)	U. S. Governments	1/2,000.0*	.....
	Central Vermont Public Service	1.0-N	.....
	Texas Gas Transmission	25.0	.....
	Kansas Nebraska Natural Gas	6.8-P	.....
	U. S. Rubber	50/60.0- -cv-rt	.....
	North Carolina State School	25.0	.....
	El Paso Natural Gas	30.0-P	.....
	J. P. Stevens	30.0-N	.....
	Southern Nevada Power	7.0-C	.....
	Ohio Thoroughfare Revenue	50.0-C	.....
	Sacramento Utility District	85.0	.....
	Grand River Dam Auth., Okla	27.0	.....
	Hetch Hetchy, California	54.0	.....
	Mississippi Valley Gas	1.5/2.0-P	.....
	Florida State Turnpike Auth	185.0-N	.....
	California Toll Bridge Bay	180.0	.....
	New York State Grade Crossing	25/40.0	.....
	Missouri State	75.0	.....
1957 JAN. 8	New England Telephone & Telegraph	35.0-C	.....
15	Louisiana Power & Light	20.0-C	.....
16	U. S. Governments	1,600.0-R	.....
JAN. No Date	New England Power	10.0-C	.....
	Niagara Mohawk Power	50.0- -cv-rt	.....
FEB. 5	Public Service of Indiana	30.0-C	.....
	U. S. Governments	7,200.0-R	.....
FEB. No Date	Elizabeth River Tunnel, Va	43.0-C	.....
MAR. 15	U. S. Governments	3/9,200.0-R	.....
MAR. No Date	General Public Utilities	.....	23.0- -rt COM
	West Penn Electric	.....	10/11.0-C-rt COM
	Appalachian Electric Power	24.0-C	.....
	Southwestern Public Service	.....	7.3-N-rt
	New Orleans Public Service	6.0-C	.....

Symbols: C—Competitive; N—Negotiated; P—Private; R—Refunding; cv—Convertible; rt—Rights; Pfd—Preferred; COM—Common. *—Estimated.

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DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.

2437 Fulton Street · Chicago 12, Illinois · District offices in principal cities

STATISTICS

New Orders Index For Industrial Machinery And Parts*
(1950 Average = 100)

	Engines & Turbines	Construction & Mining Machinery	Metalworking Machinery	Pumps & Compressors	Other Ind. Machinery	Office & Store Machinery	New Orders Index
1949	52	66	41	67	61	68	60
1950	100	100	100	100	100	100	100
1951	123	137	223	148	112	112	130
1952	94	104	146	129	85	96	98
1953	96	96	125	109	90	100	99
1954	91	96	96	108	85	105	90
1955	130	140	155	143	110	121	124
Aug 1956	190	179	150	179	120	136	142

*Includes all non-electrical machinery and parts except hand tools, operating supplies, consumer items and farm equipment. Also includes foreign and government orders except ordnance items.

Note: All figures are seasonally unadjusted. They reflect dollar value of orders and are not adjusted for price changes.

Source: McGraw-Hill, Dept. of Economics.

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	July	117.54	117.50	108.79	8.0
Peak—Class 1 Systems (million kw)	July	94.8	97.0	89.3	6.2
Estimated Dec. '56 Peak	Aug.	106.10	106.09	103.83	2.2
Production—billion kwhr	July	49.45	49.45	46.63	6.0
Hydro		9.91	10.05	9.35	6.0
Fuel		39.54	39.40	37.40	5.7
Sales—billion kwhr	Aug.	46.11	44.57	43.37	6.3
Residential		11.60	11.38	10.52	10.3
Commercial		7.95	7.74	7.40	7.4
Industrial		23.78	22.71	22.76	4.5
Other		2.78	2.73	2.68	3.7
Fuel Consumption	July				
Coal—million tons		12.00	12.34	11.74	2.2
Oil—million barrels		4.32	4.61	4.63	− 6.7
Gas—billion cu ft		136.97	127.04	127.62	7.3
Net Income Class A & B Co's—$ million	Aug.	97.17	96.86	93.14	4.3
Residential Customers—millions	12 mos.	45.10	44.99	43.84	2.9
Revenue per kwhr	ended	2.61¢	2.62¢	2.66¢	− 1.9
Avg kwhr per customer	July 31	2,899	2,879	2,662	8.9
Avg annual bill		$75.66	$75.43	$70.81	6.8

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production	Sept.	145	142	142	2.1
ENR Construction Cost	Oct.	147.6	147.8	141.3	4.5
BLS Cost-of-living	Sept.	117.1	116.8	114.9	1.9
New Orders for Machinery (1950 = 100)	Aug.	142	146	124	14.5
NEMA Sales					
Insulation materials	Aug.	153	117	147	4.1
Electric appliances		100	111	101	− 1.0
Wholesale prices	Aug.				
Motors and generators		133.3	133.1	121.8	9.4
Transformers and regulators		139.7	134.5	127.3	9.7
Switchgear and fuses		153.8	152.6	139.2	10.5
GNP—annual rate—$ billion	2nd Qtr.	408.3	403.4	387.4	5.4

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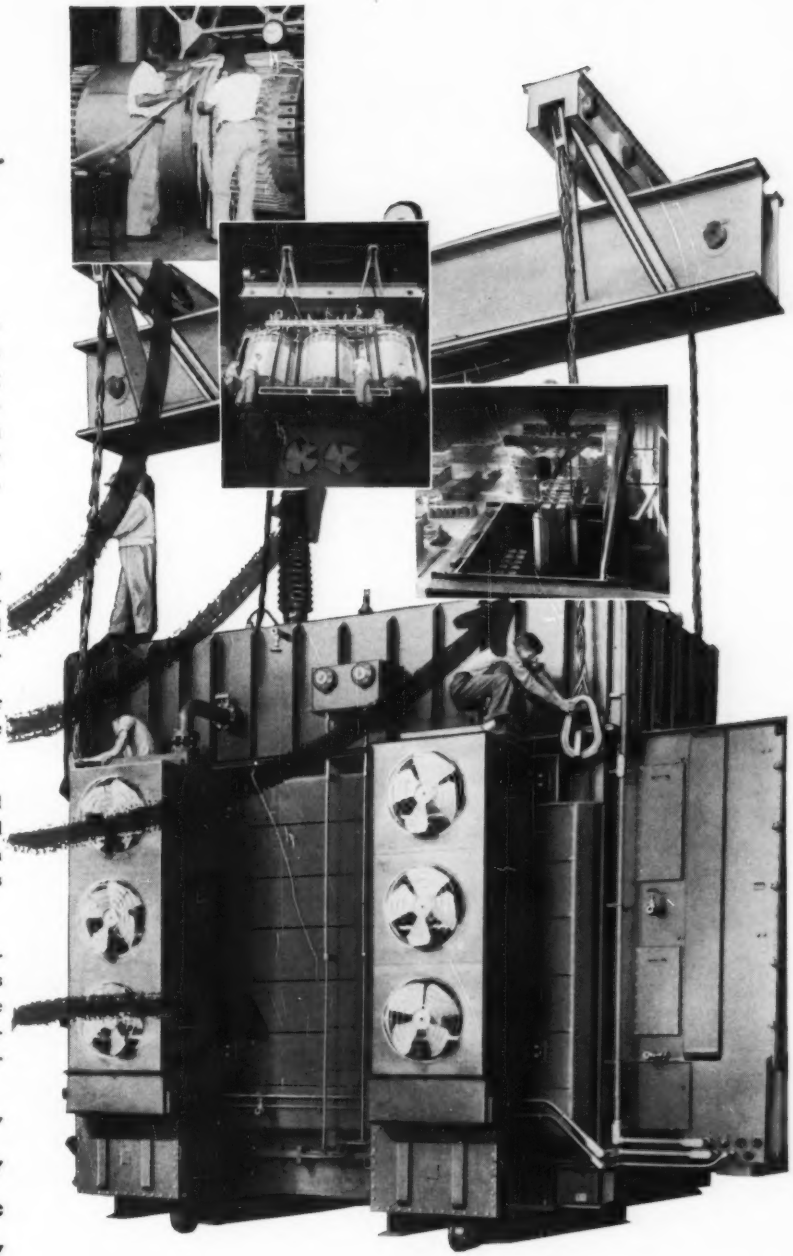

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